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Stock Assessment for British Columbia Herring in 2006 and Forecasts of the Potential Catch in 2007

Évaluation de 2006 des stocks de hareng de la Colombie-Britannique et prévisions des prises pour 2007

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ABSTRACT

Herring stock abundance in British Columbia waters was assessed for 2006 and forecasts were made for 2007 using the new age structured assessment model (HCAM) for the major stock assessment regions and for the minor stocks in Areas 2W and 27. All available biological data on total harvest, spawn deposition, and age and size composition of the spawning runs were used to determine current abundance levels. No significant problems were evident in the extent and comprehensiveness of the data collections. However, the spawn survey for the Queen Charlotte Islands was a surface rather than a dive survey due to funding constraints and fewer samples were aged in 2006 than in recent years due to limitations on the ageing laboratory. All available data were included in and summarized from an Access database. On a coastwide basis, herring abundance decreased moderately in 2006. The estimated pre-fishery biomass was 115,800 metric tonnes (t), which represents a 36% decrease over the 2005 stock level (180,900 t). The recruitment of the 2003-year class in 2006 was poor for Prince Rupert District, Central Coast, Strait of Georgia and west coast of Vancouver Island, but poor to average in the Queen Charlotte Islands. Abundance declined moderately in all areas except the Queen Charlotte Islands. The estimated harvestable surplus of BC herring in 2007 (20% of the 2007 forecast spawning stock biomass), based on forecast abundance to the five assessment regions, is 26,202 tonnes. As was the case in 2006, both the Queen Charlotte Islands and West Coast Vancouver Island stocks are below their respective Cutoff levels and can not support removals.

RÉSUMÉ

On a utilisé le nouveau modèle d'évaluation structuré par âge pour déterminer l'abondance aussi bien des stocks de hareng des principales régions d'évaluation de la Colombie-Britannique, que des petits stocks des zones 2W et 27 en 2006 et pour faire des prévisions des prises pour 2007. Toutes les données biologiques disponibles sur les prises totales, la ponte et la composition par âge et par taille des reproducteurs ont été utilisées pour déterminer le niveau d'abondance actuel. Aucun problème important n'était évident dans l'étendue et la représentativité des séries de données. Toutefois, le relevé des géniteurs a été effectué en surface plutôt qu'en plongée à cause des restrictions financières et moins d'échantillons ont été soumis à une détermination de l'âge en 2006 qu'au cours des années précédentes à cause de contraintes imposées sur le laboratoire concerné. Toutes les données ont été saisies dans une base de données Access, puis résumées. À l'échelle de la côte, l'abondance du hareng a diminué de façon modérée en 2006. L'estimation de la biomasse avant la pêche était de 115 800 tonnes métriques (t), ce qui représente une baisse de 36 % par rapport au stock de 2005 (180 900 t). Le recrutement de la classe d'âge de 2003 au sein de la population exploitable en 2006 était médiocre pour le district de Prince-Rupert, la Côte centrale, le détroit de Georgia et la côte ouest de l'île de Vancouver, mais il oscillait de médiocre à moyen dans les îles Reine-Charlotte. Pour 2007, l'estimation de l'excédent exploitable de hareng de la C.-B. (20 % de l'estimation de la biomasse génitrice de 2007), selon l'abondance prévue dans les cinq régions d'évaluation, se chiffre à 26 202 t. Comme en 2006, les stocks dans les îles Reine-Charlotte et la côte ouest de l'île de Vancouver sont inférieurs à leur seuil d'exploitation et ne peuvent soutenir aucun retrait.

INTRODUCTION

The stock assessment presented in this document differs substantially from previous reports (eg. Schweigert 2004). During discussions at the Pelagics PSARC Subcommittee meeting in May 2006, it was recommended that the herring assessment and forecasts for 2007 be based on the Herring Catch Age Model (HCAM) presented at the meeting. A full description of the model is provided in a Canadian Science Advice (CSA) research document (Haist and Schweigert, 2006). Additional model development and analysis with this implementation have been conducted and the results are described. The stock assessment and forecasts presented here essentially follow the assessment framework described in Schweigert (2005). In this document, stock assessments are presented for the five major migratory stocks and for the two significant minor stocks.

STOCK CONSIDERATIONS

The stock groupings used for the current assessments are identical to those used since 1993 (Fig. 1.). The Queen Charlotte Islands stock assessment region includes most of Statistical Area 2E, spanning from Cumshewa Inlet in the north to Louscoone Inlet in the south. The Prince Rupert District stock assessment region encompasses Statistical Areas 3 to 5. The Central Coast assessment region separates the major migratory stocks from the minor spawning populations in the mainland inlets. The Central Coast assessment region includes Statistical Area 7 plus Kitasu Bay in Area 6 and Kwakshua Channel in Area 8. The Strait of Georgia stock assessment region includes all of Statistical Areas 14 to 19, 28, 29 excluding section 293, and Deepwater Bay and Okisollo Channel in Area 13. The west coast of Vancouver Island assessment region encompasses Statistical Areas 23 to 25. The minor stocks include all of Area 27 and Area 2W from Langara Island south to but not including Louscoone Inlet. Haist and Rosenfeld (1988) outline the current geographical stock boundaries.

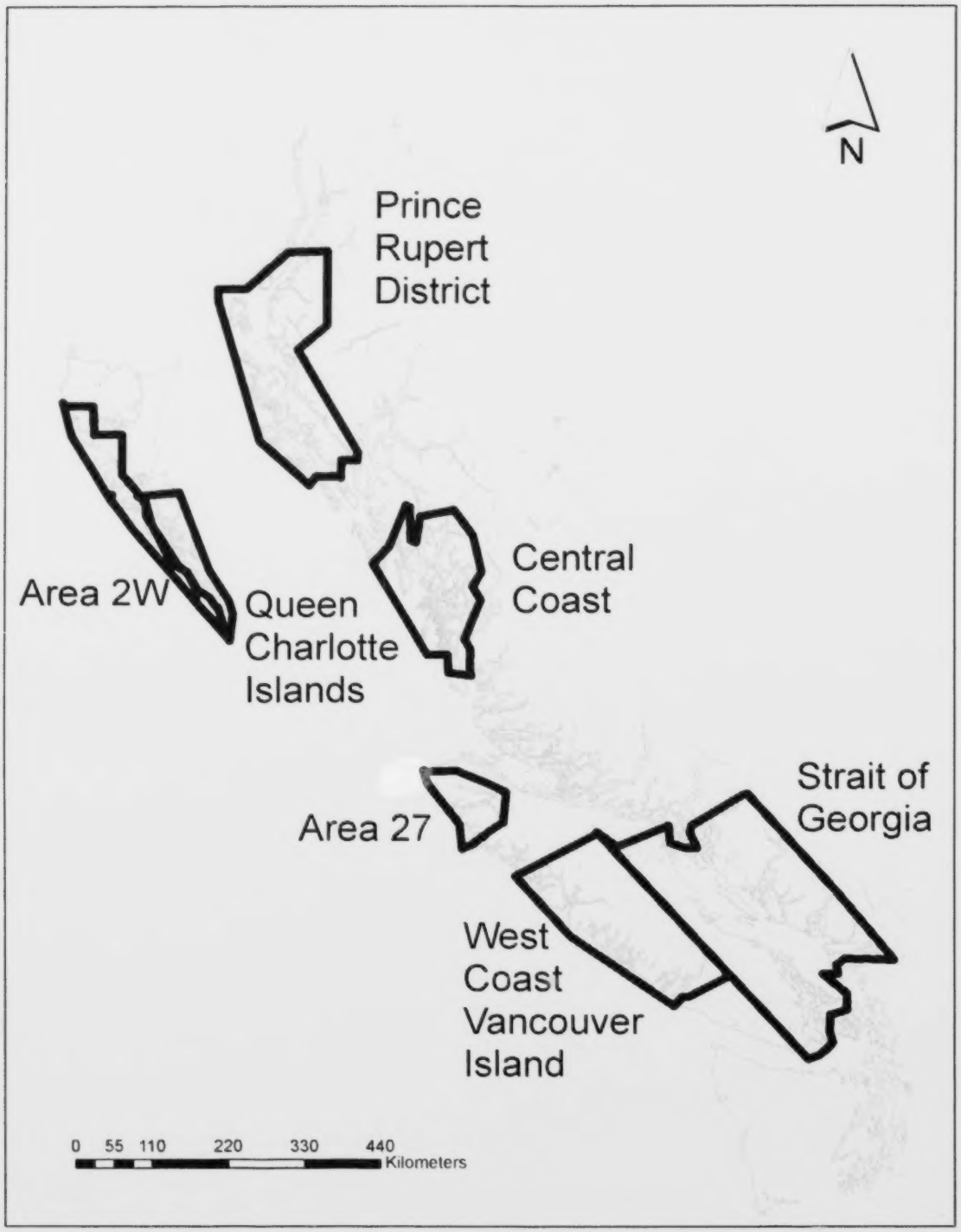


Figure 1. The five major British Columbia herring stock assessment regions: Prince Rupert District (PRD), Queen Charlotte Islands (QCI), Central Coast (CC), west coast Vancouver Island (WCVI), the Strait of Georgia (SOG) and minor stocks in Areas 2W and 27.

DATA BASE

The primary data sources for the stock assessments are spawn survey data, commercial catch landing data, and age composition data from biological samples of commercial fishery, pre-fishery charter, and research catches. These data are available in an Access database for the period 1951 to 2006. This time span includes the reduction fishery period to 1968 and the subsequent roe fishery period that began in 1972.

All major herring spawning beds except those in the QCI were surveyed in 2006 by SCUBA. Unforeseen resource limitations precluded a SCUBA survey in the QCI and the survey was conducted instead using a combination of snorkelling and surface survey techniques. A number of minor spawning beds outside the main assessment areas were also surveyed by SCUBA in 2006.

Catch information is obtained from landing slips or monitoring of plant offload data. Historically, landing slip data were summed by fishery season (seasons run from July 1 to June 30). Beginning in the 1997/98 season, roe catch figures are based on verified plant offload weights, a result of the introduction of the individual vessel quota ('pool fishery') system for all fisheries except the Strait of Georgia and Prince Rupert gillnet fisheries which were open fisheries. Beginning in the 1998/99 season, verified plant offload weights are available for all food and roe fisheries coast-wide. The history of catches in the major assessment areas is shown Figure 2.

In contrast to recent assessments, no catch was assumed for the SOK fishery as there is no basis for verifying the harvest removed from the population. Instead, the validated landed weight of SOK product was used to estimate the egg removal from the spawning grounds and these data were converted to tonnes of fish equivalents based on data provided in Shields et al. (1985). These estimates were then added to the estimated spawning biomass for each area over the course of the SOK fishery from 1975 to present.

Age structure data are used in the assessment model. The information from catch samples is used for years when there were commercial fisheries. Pre-fishery charters began in 1975 and these samples are used in addition to samples taken from the catch, particularly in areas with no fisheries, or when catch samples are few in number or not representative of the entire catch. Additional data used in both models are annual estimates of the mean weight-at-age. During the 2005/06 season a total of 212 herring samples (41 roe, 7 food and bait, 150 test fishery and 14 research samples) were collected and processed compared to 274 in the previous year. Of the roe and test fishery samples, none were collected in non-assessment areas, 9 were taken in the Queen Charlotte Islands assessment area (another 5 from Area 2W), 30 in the Prince Rupert area, 63 in the Central Coast, 71 in the Strait of Georgia, and only 13 on the west coast of Vancouver Island none of which came from Area 27. The age composition estimates for each major assessment region for 1951-2006 are presented in Figure 3 and Appendix Table 1.1-1.7.

The year of life convention for ageing adopted in the 1991 assessment is used. Fish which were previously named age 3 are now referred to as the 2^{-} age class.

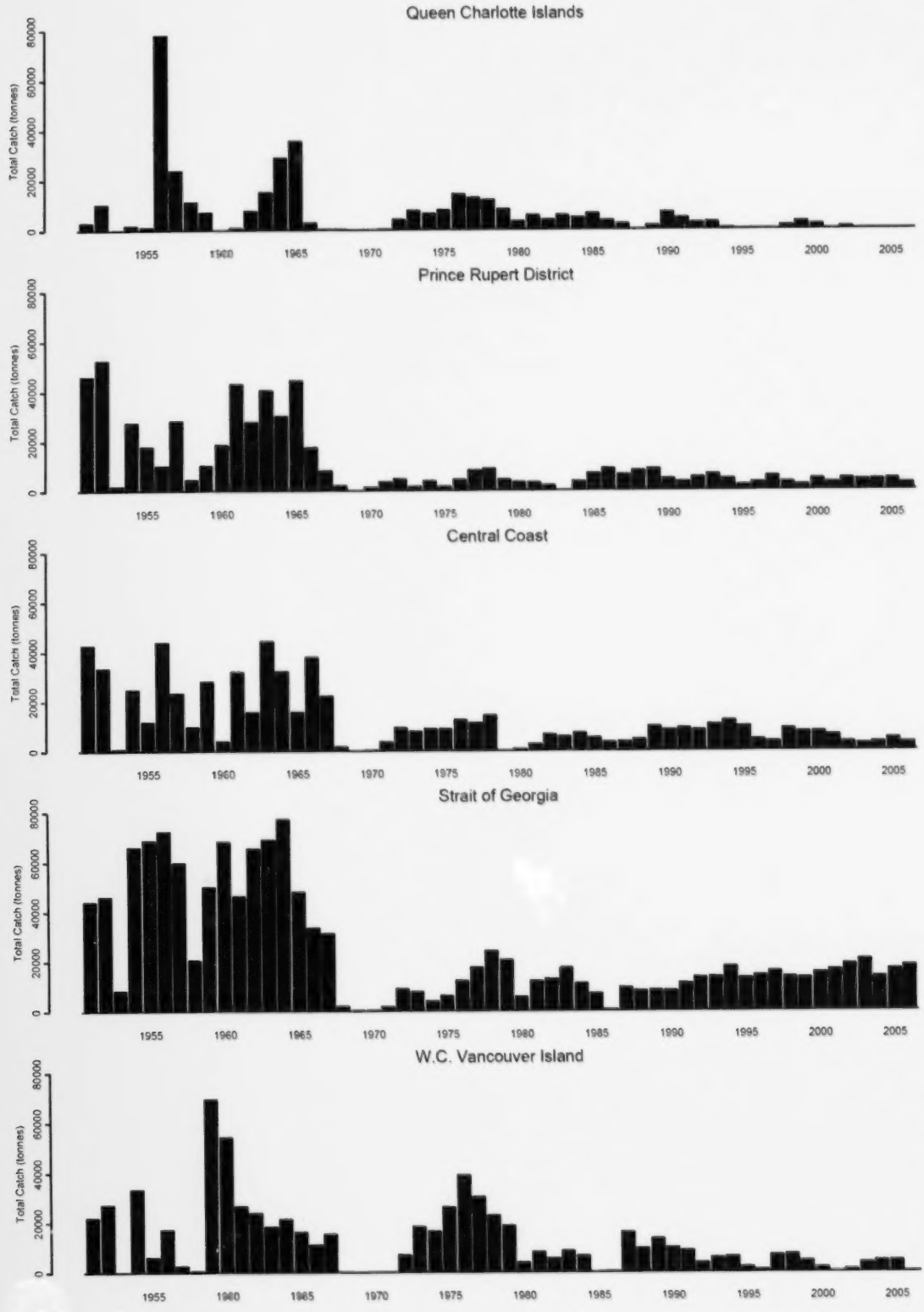


Figure 2. Estimated total catch from all fisheries except spawn-on-kelp for each assessment region from 1951-2006.

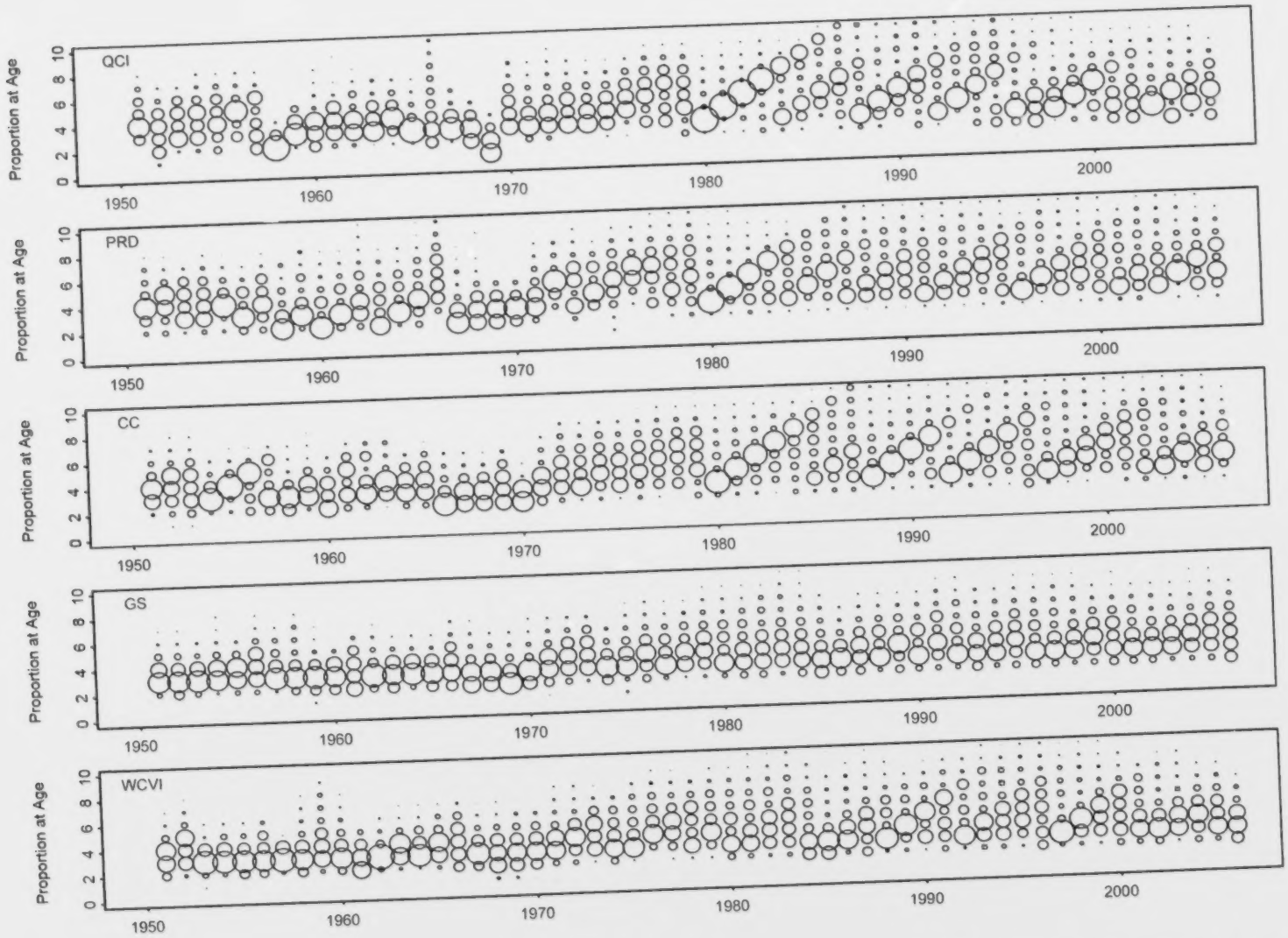


Figure 3. Age composition estimates for five major assessment regions from 1951-2006 from biological sampling. These data are used in the catch-age analysis.

GENERALIZED HERRING CATCH-AGE MODEL

In this section we provide a brief overview of the generalized herring catch-age model (HCAM), including descriptions of the options for population and fishery dynamics and the likelihoods used in fitting to observations. The model is described in detail in Haist and Schweigert (2006).

Model Dynamics

The state, or current status of the populations, partitions the fish by characters that define their distinct status. The possible characters include: age class, sex, maturity (called availability to reflect their being available to fisheries), and stock. Changes in state, or transition processes include: recruitment, natural mortality, fishing mortality, and ageing.

Time steps or fishing periods

The HCAM structure allows for a variable number of time steps (periods) each year, where each time step may have an associated fishery and natural mortality. The HCAM implementation separates the annual herring catch into three categories: a winter fishery; a spawning-season seine fishery (SN); and a spawning-season gillnet fishery (GN).

Selectivity/Availability Options

The model structure allows the distinction of fish that are available to the fishery from those that are not. The separation into available and non-available fish, which is modelled as age-specific, occurs at the beginning of the year. The available fish are subject to both fishing and natural mortality while the unavailable fish are subject to natural morality only.

A number of options are available for the parameterization of age-specific fishery selectivity and age-specific availability. These include: fixed at 1; age-based logistic functions; a size-based logistic function; and free-at-age.

Deviations from the prescribed availability-at-age or selectivity-at-age can be estimated. For availability deviations this adds an additional parameter for each year and for selectivity deviations this adds an additional parameter for each fishery. The methods for including deviations are different for the alternative parameterizations of availability and selectivity (see Haist and Schweigert 2006, Appendix A).

Fishery Dynamics and the Catch Equations

The fishery dynamics can be modelled using either the instantaneous (Baranov) form of catch equations where fishing and natural mortality are simultaneous or a discrete form of catch equations where natural mortality occurs prior to fishing. Solution of the catch equations can be done analytically (using an iterative Newton-Raphson algorithm for the instantaneous form) or by estimating parameters that define fully-selected fishing mortality rates. In the first case the implied assumption is that there is no error in the catch data while the second case acknowledges error in the catch data.

Natural Mortality

A number of options representing different assumptions about natural mortality rates are available. These include: fixed or estimated values for the constant natural mortality rate; age-dependent natural mortality rates; annual deviations from an average natural mortality rate; and a time-series approach using a "random walk" (Gudmundsson 1994) to parameterize annual changes in natural mortality rates (described in Haist and Schweigert 2006, Appendix A).

Stock-Recruitment Assumptions

A Beverton-Holt type stock-recruitment relationship is implemented in HCAM, using the "steepness" parameterization (Mace and Doonan 1988, Francis 1992). Estimated parameters of the stock-recruitment relationship are: R_0, the average recruitment at the unfished equilibrium biomass level (B_0); steepness (h), the fraction of R_0 that is expected at 20% of B_0 ; and the variance of the residuals from the stock-recruitment relationship (σ_r).

Initializing the Populations

The populations can be initialized either by estimating parameters for the number of fish in each age-class in the first year of the analysis, or by assuming equilibrium conditions in the first year. Equilibrium conditions can be estimated for populations that are subject only to natural mortality prior to the first year or they can be estimated for populations that are subject to a constant exploitation rate and natural mortality prior to the first year.

HCAM models a "plus" age-class, which accumulates all fish of the "plus" age and older.

Ageing Errors

Two options for estimating ageing errors are incorporated into HCAM. The first option estimates two vectors for ageing errors – these represent the probabilities at each age of under-ageing fish by one year and the probabilities at each age of over-ageing fish by one year. The second option is based on an ageing error model developed by Francis (2003). The basis of this model is the assumption that for each ring in the ageing structure there is a probability that the ring will not be counted and second a probability that two rings will be counted. Thus, the probability of ageing error increases with age and may be asymmetrical.

Parameter Estimation

HCAM is structured for Bayesian estimation, though by not specifying parameter priors maximum likelihood estimation can be done. HCAM uses the ADMB model package (Otter Research 2000). ADMB allows multi-phase estimation, where initially some parameters are held fixed while the minimization is carried out, then some of the fixed parameters are freed and the minimization carried out, etc. For Bayesian analyses, ADMB uses the MCMC algorithm (Gelman et al. 1995) to estimate the joint posterior probability densities. Posterior densities are based on MCMC chains of length 1 million in this analysis.

Likelihoods

For age composition data, HCAM has two likelihood options. These are the multinomial distribution and a robust-normal distribution (Fournier et al. 1990, Starr et al. 1999).

For fitting the spawn index data, HCAM only models the lognormal distribution.

Priors

The priors implemented in HCAM include uniform, normal, and lognormal distributions (Haist and Schweigert 2006, Appendix A).

Residuals

To assess deviations from model assumptions we examine two types of residuals; Pearson residuals which express the residual relative to the variability of the observation and normalized residuals which express the residual on a standard normal scale (see Haist and Schweigert 2006, Appendix A for descriptions). For the normalized residuals we calculate two statistics; the standard deviation of the normalized residuals (SNDR) which has an expected value of 1, and a potentially more robust statistic, the median of the absolute residuals (MAR) which has an expected value of 0.67.

FORMULATION OF THE HCAM MODEL

The herring catch-age analysis (HCAM) presented at the 2006 spring PSARC meeting (Haist and Schweigert 2006) combined features of the model currently used for herring assessments (Schweigert 2005) and an alternative developed for the objectives based fishery management initiative (OBFM) referred as the new age-structured model (NASM, Fu et al. 2004). The HCAM computer code is designed to be general and it can be run to mimic both the existing herring age-structure model (EASM) and the new age-structure model (NASM) as well as various combinations of these and others. The Pelagics Subcommittee selected the R13 HCAM formulation for future assessments because it combined features of: only minor retrospective patterns; no obvious patterns in model residuals; consistency between the assumed and empirical error structure; and model parsimony.

The suite of HCAM model runs presented by Haist and Schweigert (2006) was not comprehensive, and prior to conducting analyses for the current herring stock assessment some additional runs were compared to assess whether better formulations of the model were possible. This series of runs initially looked at simplifying the model assumptions (R15 and R16), then looked at some different structural assumptions (R17, R18, and R19), and finally introduced additional model complexity to deal with the retrospective patterns (R20). A description of the options included in the different runs is presented in Table 1. The runs were conducted using data through 2005, and a brief summary of results follows.

Run R13

The run R13, considered the preferred run of those previously presented, is taken as the reference run against which the new runs are compared. Features of R13 are described in Haist and Schweigert (2006).

Run R15

Run R15 differs from run R13 in that no ageing error is assumed. This reduces the number of parameters to be estimated by 2. For the GS and CC stocks the increase in the objective function value is small (Table 1), suggesting the additional parameters do little to improve the model fit. Intermediate increases in the objective function values were obtained for the WCVI and QCI stocks, while for the PRD stock there was actually an improvement in model fit when the ageing error terms were not estimated. This suggests the PRD R13 fit was a local minima. The PRD fit to age-composition data improves and the fit to spawn index data degrades for the R15 run (see the standard deviation of normalized residuals statistics in Table 2). Overall, the assumption of ageing errors does not appear to be warranted, given no major improvements in model fits for the 5 stocks.

Run R16

Run R16 differs from run R15 in that natural mortality is assumed to be constant with age. This reduces the number of parameters to be estimated by 1. The increase in the objective function value is small (or non-existent) for 3 of the 5 stocks, with only the WCVI and CC stocks showing somewhat better fits when age-dependent natural morality is assumed. We consider the simpler model (R16) preferable over the more complex model (R15).

Run R17

The next set of model runs incorporates a substantial change in structural assumptions with the population dynamics modelled by the "availability" formulation, which assumes that all mature (i.e. available) fish are equally selected by the seine fisheries. The availability formulation is consistent with a fishery that is non-selective for fish on the spawning grounds. This set of runs, R17, does not change the number of parameters that are estimated.

For 3 of the 5 herring stocks (GS, CC, and PRD) there is considerable improvement in model fit with the "availability" parameterization (Table 2). For the WCVI stock the selectivity parameterization is only slightly better than the availability parameterization and for the QCI stock the selectivity parameterization clearly produces a better fit. The autocorrelation in the spawn index residuals is reduced with the availability parameterization for all stocks but QCI. Overall, the availability formulation of the population dynamics appears to provide a more consistent fit to the herring data.

Run R18

The set of runs R18 is the same as the set R17 except that the populations are initialized in 1951 and not assumed to be at equilibrium in that year. The previous runs initialized the populations in 1943, assumed initial equilibrium conditions, and assumed no catch prior to 1951. The revised formulation is more consistent with what we know about the fisheries and population dynamics (fisheries occurred prior to 1951, and the populations show large fluctuations independent of fisheries).

The set of runs R18 has the same number of parameters as the set R17, and provides slight improvements in model fits for 4 of the 5 stocks (Table 2). This is clearly the preferred parameterization.

Run R19

The R19 set of runs introduces another substantial change to the population dynamics. For this run we remove the inter-annual variation in natural mortality parameters and include annual variation in the availability parameters (with standard deviation of 0.25). The total number of parameters does not change from the R18 runs.

This change in model assumptions results in substantial improvement in model fits for all 5 stocks (Table 2). The improvements primarily result from better fits to the age-composition data (see age-composition summary statistics in Table 2). Based on model fits, this would appear to be a preferred model formulation.

A retrospective analysis was conducted using the R19 model formulation and retrospective years from 1996 through 2003. Results from these retrospective runs are compared with those from R13 and R18 retrospective analyses in Table 3. Overall, the results are similar for the R13 and R18 analyses, with a mean absolute change in spawning biomass estimates of 14.1% for the R13 runs and 13.5% for the R18 runs. However, the retrospective pattern is substantially worse for the R19 runs with a mean absolute error of 34.6%. For virtually all stocks and retrospective years there is a negative bias in the initial estimates of spawning biomass (Table 3). Therefore, although the R19 model formulation is superior in terms of data fits, it is unacceptable in terms of the retrospective pattern.

Run R20

For the set of runs R20 we maintain the structure of R19 but re-introduce the annual deviations in natural mortality rates. The availability deviations evaluated in R19 are maintained because they significantly improved the model fits. The annual deviations in natural mortality (random walk parameterization with a standard deviation of 0.25) are included to see if this will improve the retrospective patterns.

The retrospective pattern is improved for the R20 run (Table 3), with a mean absolute change in spawning biomass estimates of 14.3%. This model formulation is used as the base case for the 2006 herring stock assessment.

Three additional sets of runs, using the R20 model formulation but with a different sequence of phasing in parameter estimation, were conducted to determine if there were problems with attaining local minima solutions. In all cases the same minima resulted, suggesting this model formulation does not have substantial local minima problems.

Table 1. Description of the options included in various runs of the HCAM model. See Haist and Schweigert (2006) for a more detailed description.

	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Run 10	Run 11	Run 12	Run 13	Run 13	Run 15	Run 16	Run 17	Run 18	Run 19	Run 20
R_0-BH	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
d_{iR}	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Steepness	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Avg M	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Age-dependM								Y	Y	Y	Y	Y	Y	Y	Y					
Annual M devs									Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
Recruitment Variance	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const	Y const - 1951	Y const - 1951	Y const - 1951
Selectivity	Y - 4	Y - 2	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 7	Y - 2	Y - 2	Y - 2	Y - 2
Selectivity devs											Y	Y								
Availability ogive		Y – 2															Y	Y	Y	Y
Q	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 2	Y - 1	Y - 2	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1	Y - 1
Ageing error					Y	Y	Y	Y	Y	Y	Y	Y	Y	Y						
Age of +group	10	10	10	10	10	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Age-comp proc error	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.003	.009	.009	.009	.009	.009	.009	.009	.009
Annual variation in availability																			Y	Y

Table 2. Summary statistics for the HCAM series of model runs (R3, R15-R20) for the five herring stocks. Statistics include the objective function value (F), the standard deviation of normalized residuals (SDNR), the median absolute normalized residual (MAR), the autocorrelation (AC) in the spawn index residuals, and the number of parameters estimated in the minimization (NVAR). The results are from analyses using data through 2005. The run R20* uses data through 2006.

Stock	Statistic	R13	R15	R16	R17	R18	R19	R20	R20*
GS	F	404.3	408.4	408.4	381.8	381.4	252.2	233.6	272.0
WCVI	F	389.0	398.1	406.2	408.9	406.1	333.9	286.7	284.5
CC	F	460.9	462.4	470.3	455.9	452.7	279.4	269.6	242.3
PRD	F	892.2	890.1	890.2	832.7	829.1	572.7	557.0	554.9
QCI	F	606.3	611.5	612.0	622.1	624.0	441.7	408.6	350.6
Age composition									
GS	SDNR	0.98	0.99	0.99	0.96	0.96	0.77	0.78	1.43
	MAR	0.55	0.59	0.59	0.55	0.52	0.44	0.45	0.46
WCVI	SDNR	1.24	1.28	1.32	1.32	1.31	1.14	1.14	1.14
	MAR	0.58	0.59	0.60	0.58	0.58	0.57	0.55	0.56
CC	SDNR	1.20	1.20	1.23	1.21	1.21	0.94	0.93	0.85
	MAR	0.60	0.62	0.64	0.57	0.57	0.50	0.49	0.50
PRD	SDNR	1.90	1.69	1.69	1.68	1.68	1.30	1.29	1.30
	MAR	0.92	0.89	0.90	0.87	0.87	0.74	0.72	0.70
QCI	SDNR	2.48	3.27	3.40	2.18	2.83	1.35	1.41	1.40
	MAR	0.76	0.79	0.79	0.77	0.76	0.72	0.70	0.67
Spawn Data									
GS	SDNR	0.95	0.97	0.97	0.92	0.93	0.82	0.78	0.79
	MAR	0.64	0.67	0.67	0.60	0.54	0.52	0.51	0.50
WCVI	SDNR	0.98	1.00	0.93	0.84	0.85	1.12	0.89	0.87
	MAR	0.60	0.60	0.54	0.57	0.57	0.74	0.57	0.43
CC	SDNR	1.16	1.16	1.18	1.08	1.08	1.09	0.93	0.97
	MAR	0.72	0.74	0.79	0.64	0.61	0.75	0.57	0.65
PRD	SDNR	1.15	1.43	1.44	1.04	1.05	1.27	1.19	1.20
	MAR	0.45	0.72	0.72	0.57	0.60	0.65	0.60	0.79
QCI	SDNR	1.37	1.36	1.36	1.54	1.64	1.33	1.12	1.10
	MAR	0.72	0.77	0.74	0.81	0.94	0.91	0.66	0.62
GS	AC	0.25	0.26	0.26	0.19	0.17	0.38	0.38	0.38
WCVI	AC	0.46	0.45	0.38	0.14	0.15	0.31	0.09	0.09
CC	AC	0.31	0.31	0.26	-0.06	-0.07	0.27	0.12	0.05
PRD	AC	0.08	0.38	0.38	-0.01	0.00	-0.01	-0.12	-0.11
QCI	AC	0.01	0.01	0.00	0.21	0.24	-0.10	-0.21	-0.21
	NVAR	132	130	129	129	129	129	184	186

Table 3. Summary statistics for retrospective changes in stock biomass estimates from the HCAM model runs for the five herring stocks.

		$100\left(B_y^y - B_y^{2005}\right)/B_y^{2005}$								
Run	*Stock*	*Mean*	*Mean absolute*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*
R13	GS	17.1	17.1	25.3	8.4	10.3	11.0	28.5	25.1	15.5	12.5
	WCVI	-3.8	12.4	9.2	-1.6	-26.3	-21.6	-6.4	13.0	12.1	-8.9
	CC	0.7	7.0	-11.0	-1.2	14.7	15.8	0.4	-10.6	-0.5	-1.9
	PRD	14.2	18.1	18.2	29.6	36.0	17.3	10.8	-15.6	12.1	4.8
	QCI	-6.4	16.2	-4.5	19.7	-1.0	-8.4	-2.8	-70.3	19.4	-3.4
	Mean	4.3	14.1								
R18	*GS*	8.3	8.5	0.8	1.5	11.5	8.7	26.0	6.5	12.5	-0.8
	WCVI	-13.1	18.1	1.0	-22.4	-46.4	-31.5	0.0	14.0	4.7	-24.4
	CC	-5.5	5.5	-7.5	-11.5	-6.6	-1.7	-5.5	-8.1	-3.2	0.0
	PRD	-0.8	13.2	4.8	8.4	15.9	8.4	12.2	-27.6	-13.4	-15.0
	QCI	-18.5	22.1	-2.1	3.3	-44.6	-30.0	-6.8	-64.2	11.1	-14.8
	Mean	-5.9	13.5								
R19	*GS*	-8.2	9.5	-22.2	-17.9	-3.3	-5.5	5.4	-8.2	-4.1	-9.3
	WCVI	-61.7	61.7	-35.1	-40.6	-88.3	-86.1	-80.0	-46.4	-43.8	-73.2
	CC	-21.5	21.5	-6.2	-13.7	-27.6	-25.9	-19.6	-30.6	-26.8	-21.9
	PRD	-33.6	33.6	-26.7	-33.4	-11.2	-25.8	-28.2	-55.6	-57.2	-30.6
	QCI	-46.6	46.6	-22.7	-4.5	-34.3	-76.3	-65.0	-108.0	-25.1	-37.0
	Mean	-34.3	34.6								
R20	*GS*	-11.7	14.4	-5.3	-0.8	9.4	-14.9	1.7	-31.1	-19.1	-33.2
	WCVI	-4.0	13.5	-5.9	3.4	-20.0	-7.2	-1.1	20.8	13.9	-35.8
	CC	-10.8	10.8	-5.4	-13.1	-22.3	-12.3	-4.8	-13.2	-3.6	-11.9
	PRD	-12.3	17.2	-8.3	-3.9	19.6	-3.9	-1.8	-48.7	-33.4	-18.0
	QCI	5.6	15.5	18.1	13.5	10.5	-19.0	9.6	-17.8	32.6	-2.7
	Mean	-6.6	14.3								

STOCK TRENDS AND ABUNDANCE FORECASTS

Estimates of pre-fishery spawning stock biomass over the period 1951 to 2006 from the HCAM and EASM model used in the 2006 assessment are presented in Figures 4 and 5 for the five major coastal regions. Overall, there is reasonably good agreement between the two models with some notable exceptions. In the Central Coast the HCAM implementation suggests a much stronger 1977 year-class than the EASM model resulting in higher biomass estimates for the early 1980s. Subsequently, estimates are similar although HCAM estimates are slightly higher over the past decade. HCAM estimates for the Strait of Georgia and west coast of Vancouver Island are also substantially higher than EASM estimates since 1980. In particular, the 1977 year-class appears much larger than previously estimated. However, both models indicate similar estimates of current abundance.

Estimates of the spawn index, spawning biomass and pre-fishery biomass determined by the HCAM implementation are presented in Figures 6 and 7 for the northern and southern migratory herring stocks. All stocks except the QCI suggest a dramatic decline in abundance in 2006 with all stocks except the Strait of Georgia estimated to be near or below the Cutoff level.

Residual and Retrospective Analysis

An examination of residuals provides the basis for assessing the fit of the model to the available data. The model estimate of the population egg production can be compared to the observed egg deposition and residuals reviewed for lack of model fit. The results of this comparison are shown in Figures 8 and 9 for the five major stocks. It is evident that the residuals have decreased over time in all areas since the inception of diving surveys in 1988. The standardized residuals presented here differ from those in previous assessments but are in the expected range of variation. The residuals for the SG and WCVI suggest some cyclic variation that is not currently captured in the model formulation.

The residuals from the catch-age data are presented in two ways. First, the normalized residuals from the age-composition fit are presented for the three fishing periods over time for the five major stocks in Figures 10 to 14. These residuals are substantially improved relative to recent assessments. A few large residuals remain but there are no clear patterns or trends in residuals evident over time or age in any area. The underlying data resulting in the largest residuals will be re-evaluated and may be removed for future assessments. The normalized residuals are also presented as a function of age averaged over years in Figure 15. Overall, there is very good agreement between the observed and estimated age-composition with few observations falling outside the 10 and 90% quantiles.

The estimates of natural and fishing mortality over the time period from 1951-2006 are presented in Figure 16. The average natural mortality rate estimates range between 0.55 and 0.93 with the highest levels in the QCI and WCVI. All stocks except the Strait of Georgia indicate an increasing trend in natural mortality since the early 1990s with the most marked effect in the WCVI stock. All stocks show a peak in natural mortality during the stock collapse of the late 1960s. Fishing mortality rates have decreased significantly in all stocks following the high levels during the reduction period and the subsequent collapse. Fishing mortality rates have been low and stable in all stocks since the early 1980s.

A retrospective analysis for the HCAM model version R20 is presented for each of the major herring stocks in Figures 17. The plots show the stock trajectory determined for each year since 1996 demonstrating the effect of additional data on model performance relative to the estimates from the stock trajectory in the current year. The 95% confidence bands from the posterior distribution from the Bayesian analysis are also shown. In general, the retrospective patterns are very stable for all stocks with some minor exceptions for the Strait of Georgia since the 1970s. The retrospective patterns are much improved from recent assessments and suggest consistency in the interpretation of the data over time.

Trace plots from the sub-sampling of the MCMC posterior distribution for estimated 2006 spawning stock biomass are presented in Figure 18. The plots show no evidence of trends over the course of the analysis. A total of 2000 samples were retained over the course of the 1 million simulations.

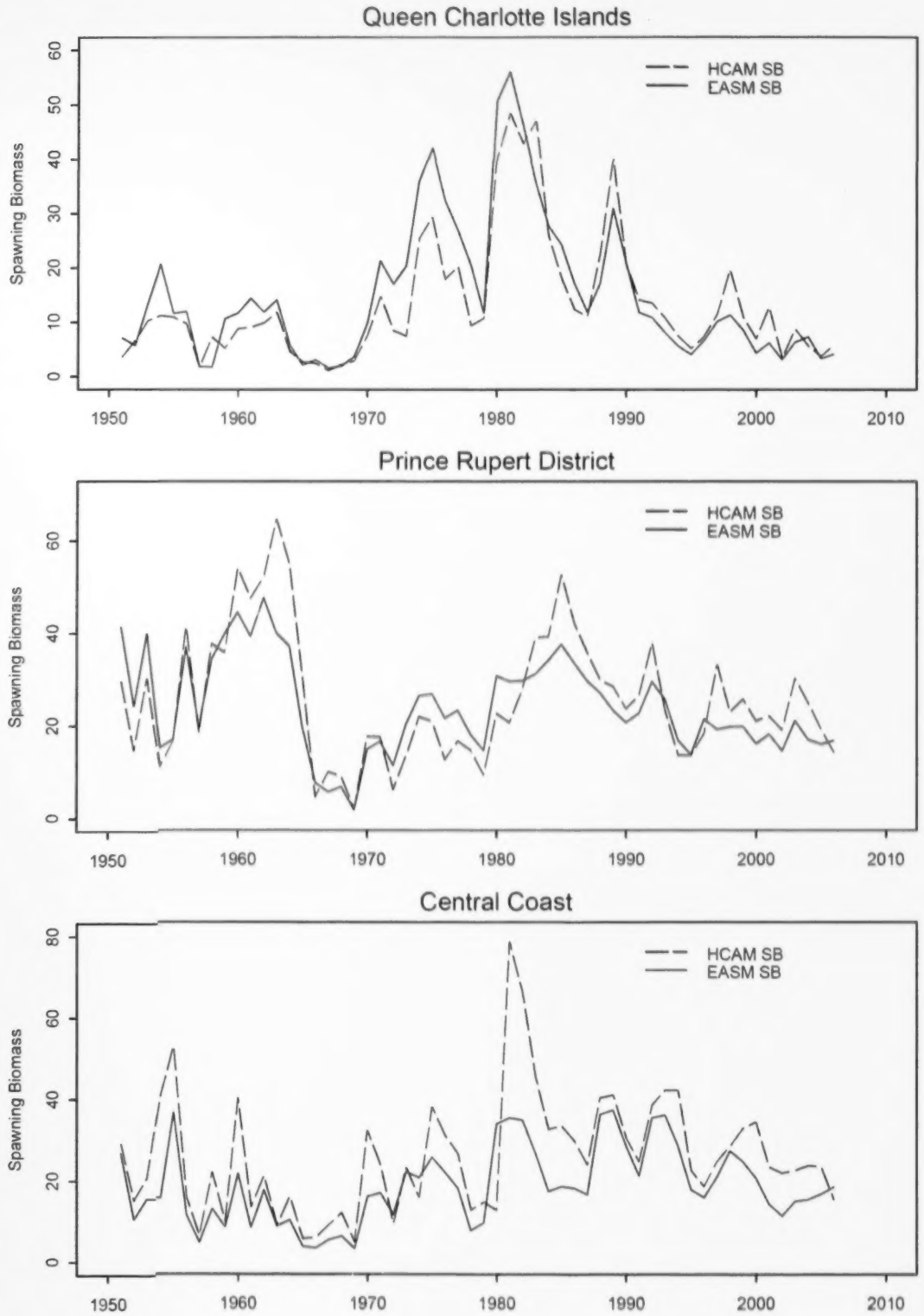


Figure 4. Comparison of HCAM and EASM estimates of spawning biomass for northern herring stocks for the period 1951-2006.

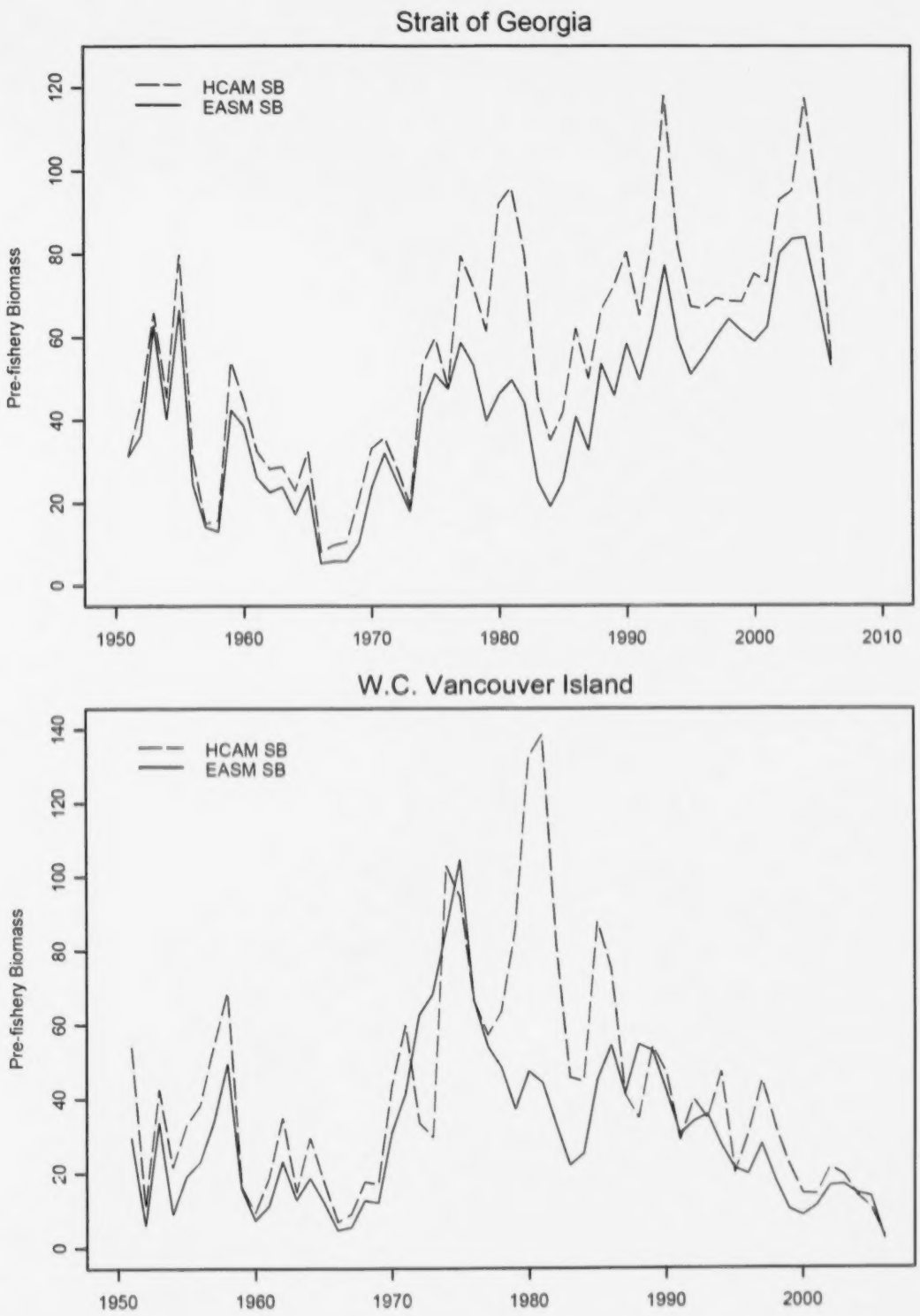


Figure 5. Comparison of HCAM and EASM estimates of spawning biomass for southern herring stocks for the period 1951-2006.

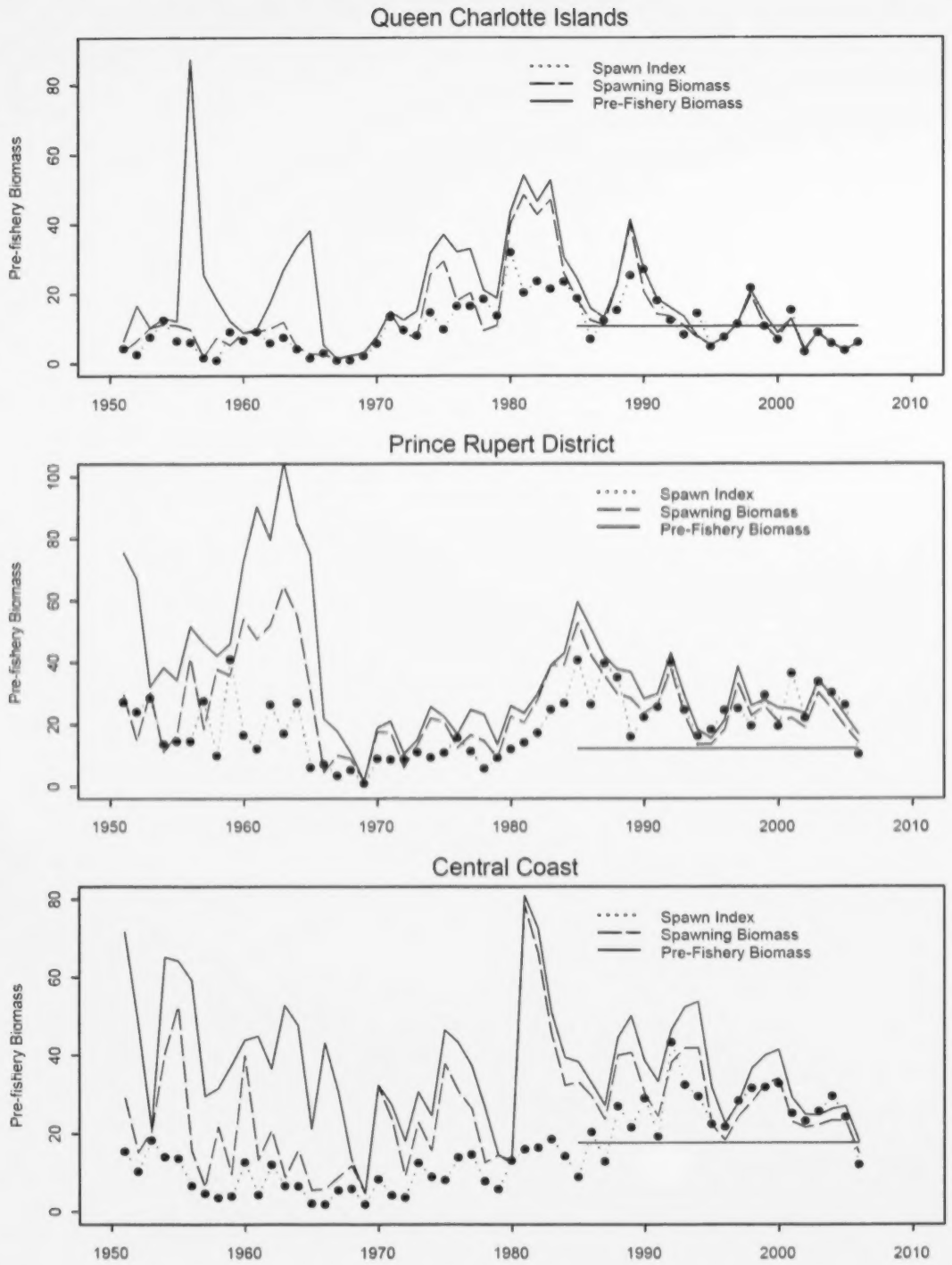


Figure 6. Estimates of pre-fishery spawning stock biomass (tonnes x 1000) from age-structured model (HCAM) analyses for northern B.C. herring stock assessment regions, 1951-2006. Horizontal line indicates the Cutoff level.

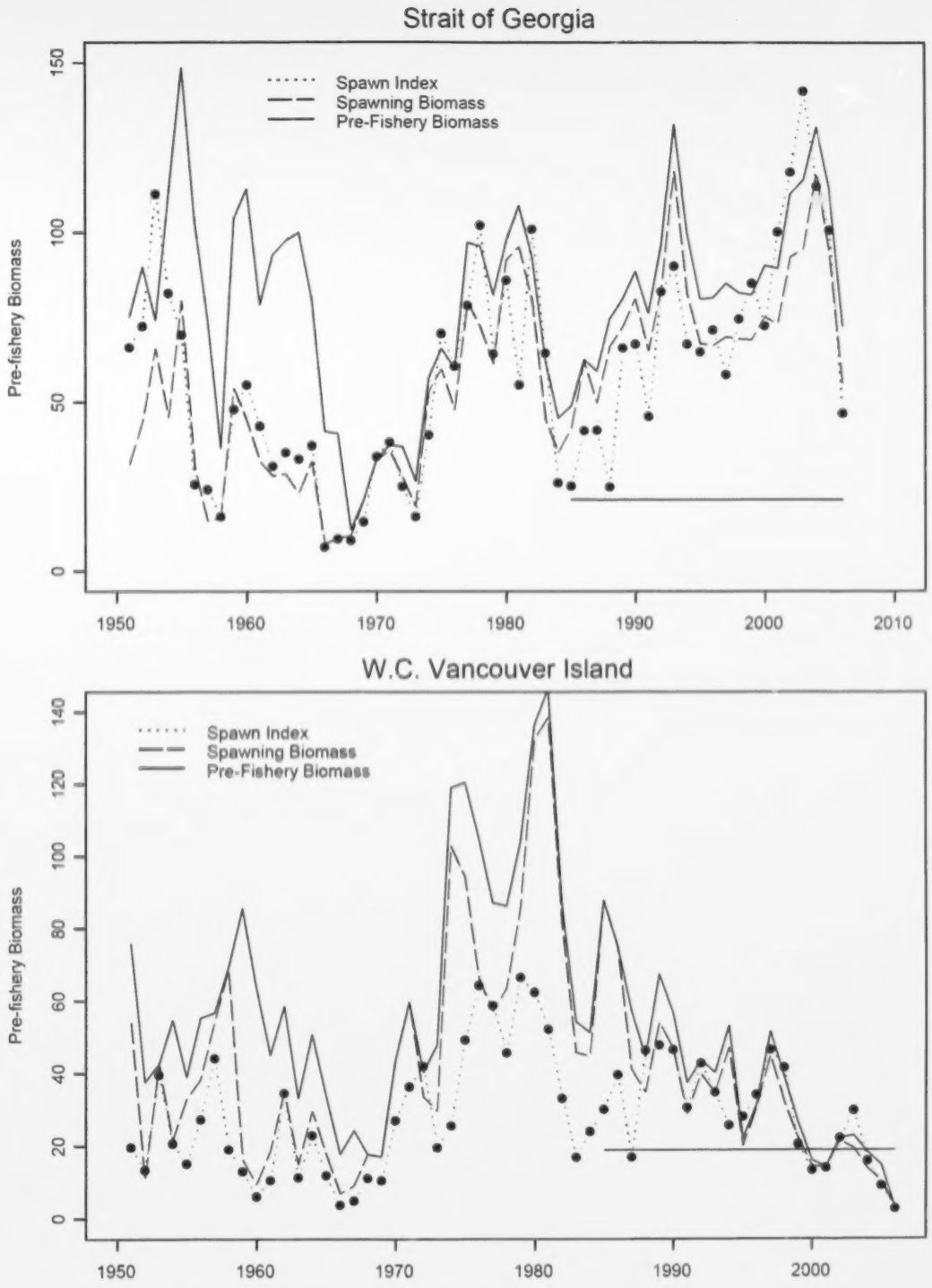


Figure 7. Estimates of pre-fishery spawning stock biomass (tonnes x 1000) from age-structured model (HCAM) analyses for southern B.C. herring stock assessment regions, 1951-2006. Horizontal line indicates the Cutoff level.

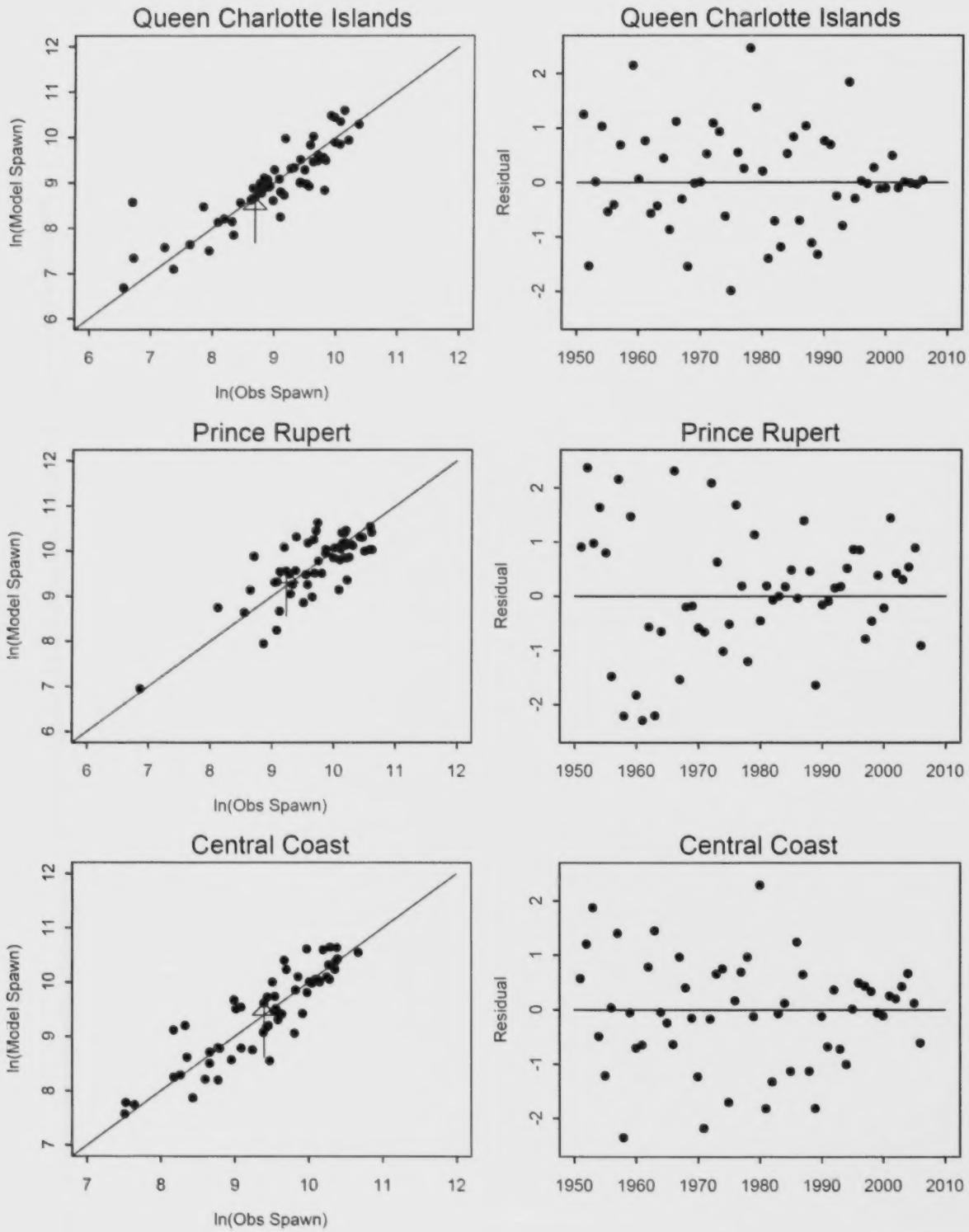


Figure 8. The residuals from the observed spawn - true spawn relationship for the northern assessment regions for the period 1951-2006. The arrow indicates the most recent data point.

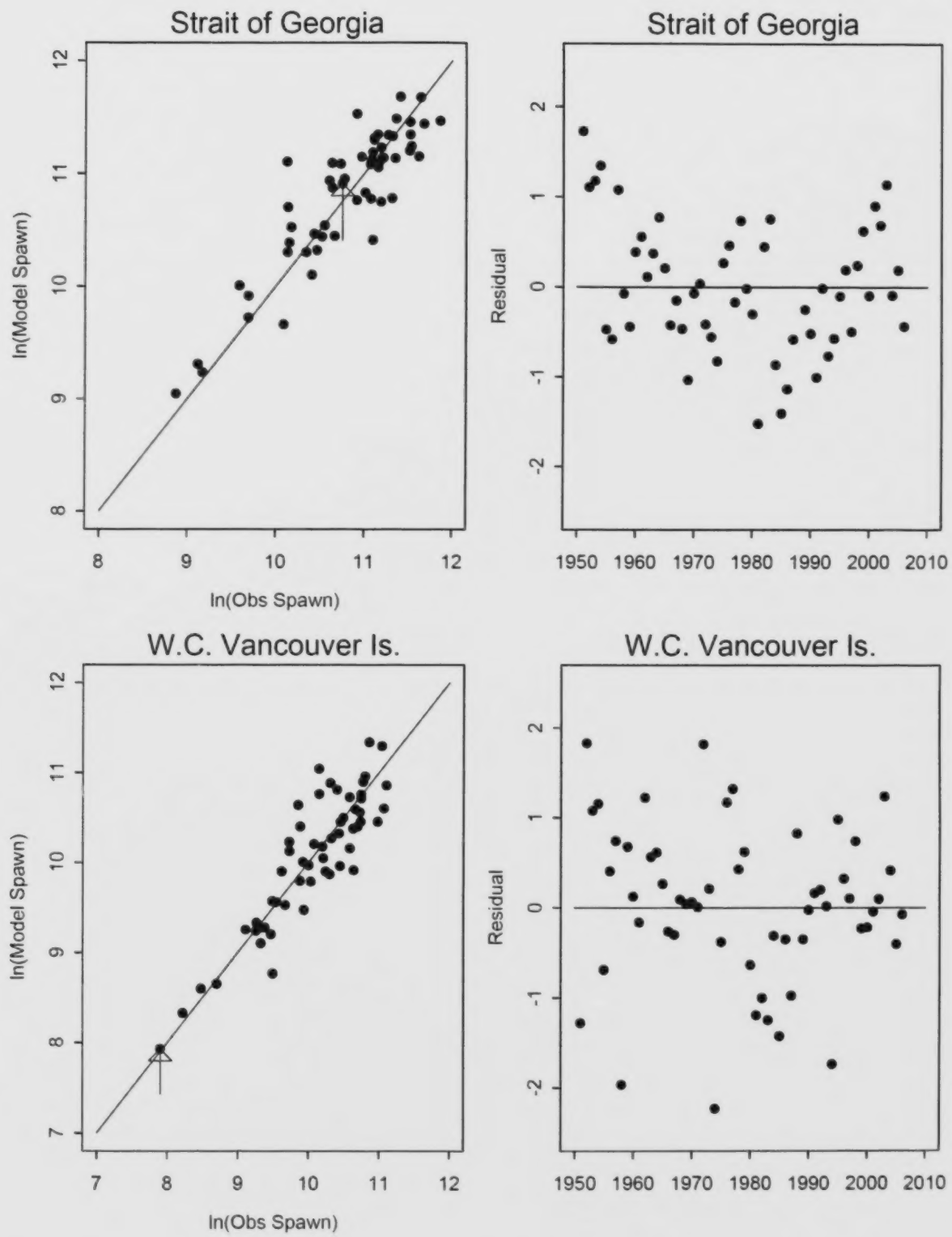


Figure 9. The residuals from the observed spawn - true spawn relationship for the southern assessment regions for the period 1951-2006. The arrow indicates the most recent data point.

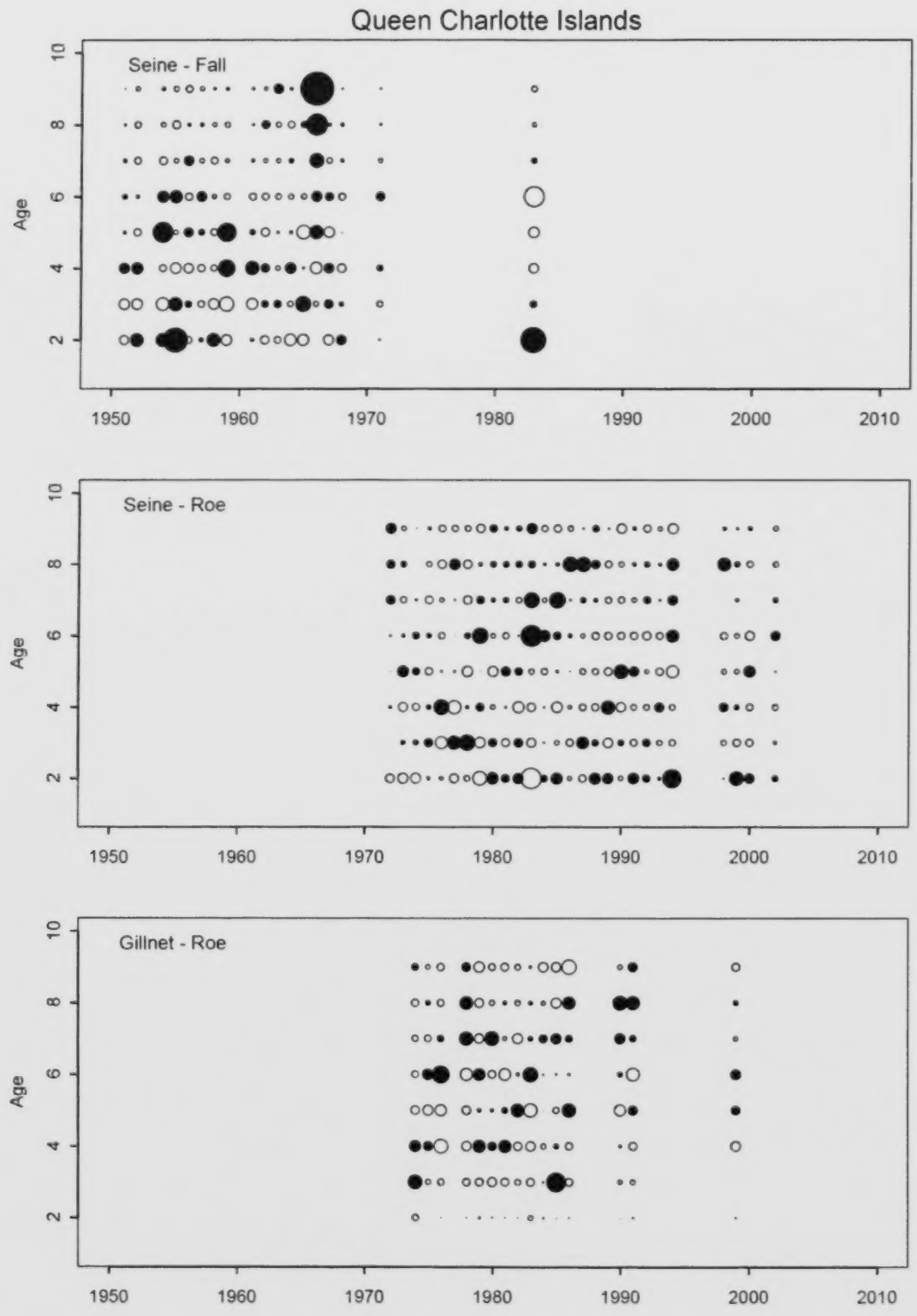


Figure 10. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Queen Charlotte Islands, 1951-2006. Filled circles are positive residuals and open circles are negative residuals.

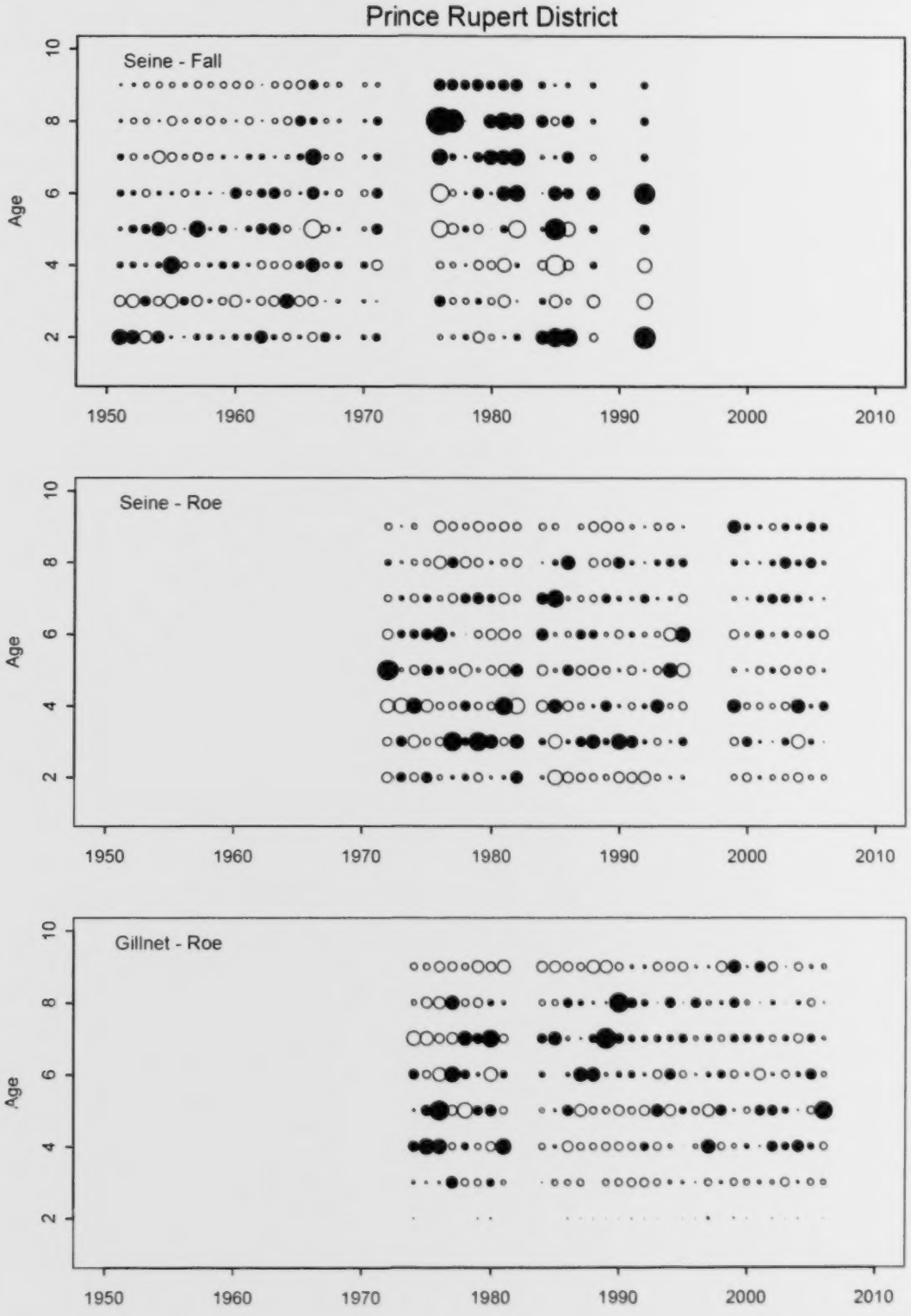


Figure 11. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Prince Rupert District for 1951-2006. Filled circles are positive residuals and open circles are negative residuals.

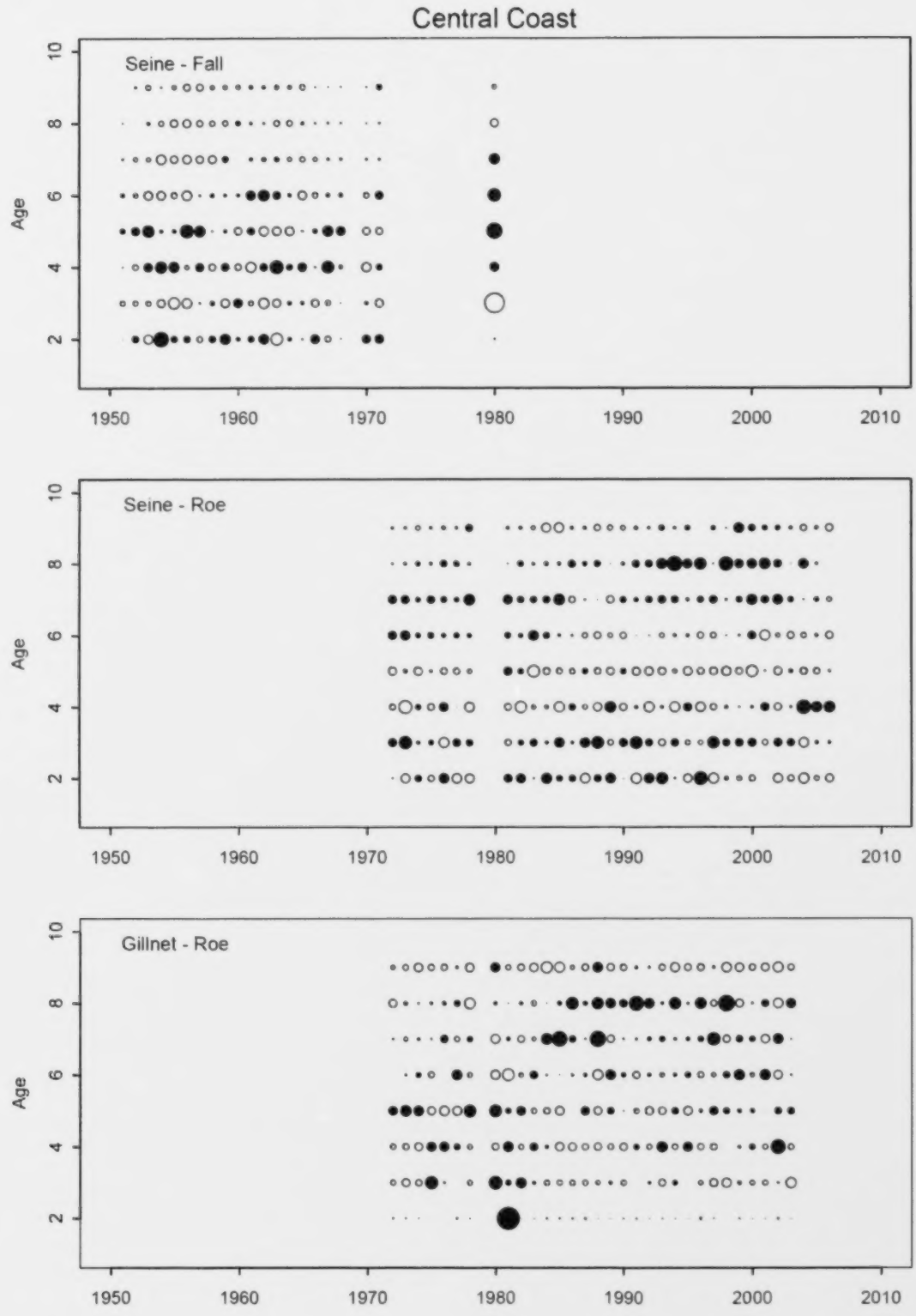


Figure 12. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Central Coast for 1951-2006. Filled circles indicate positive residuals and open circles are negative residuals.

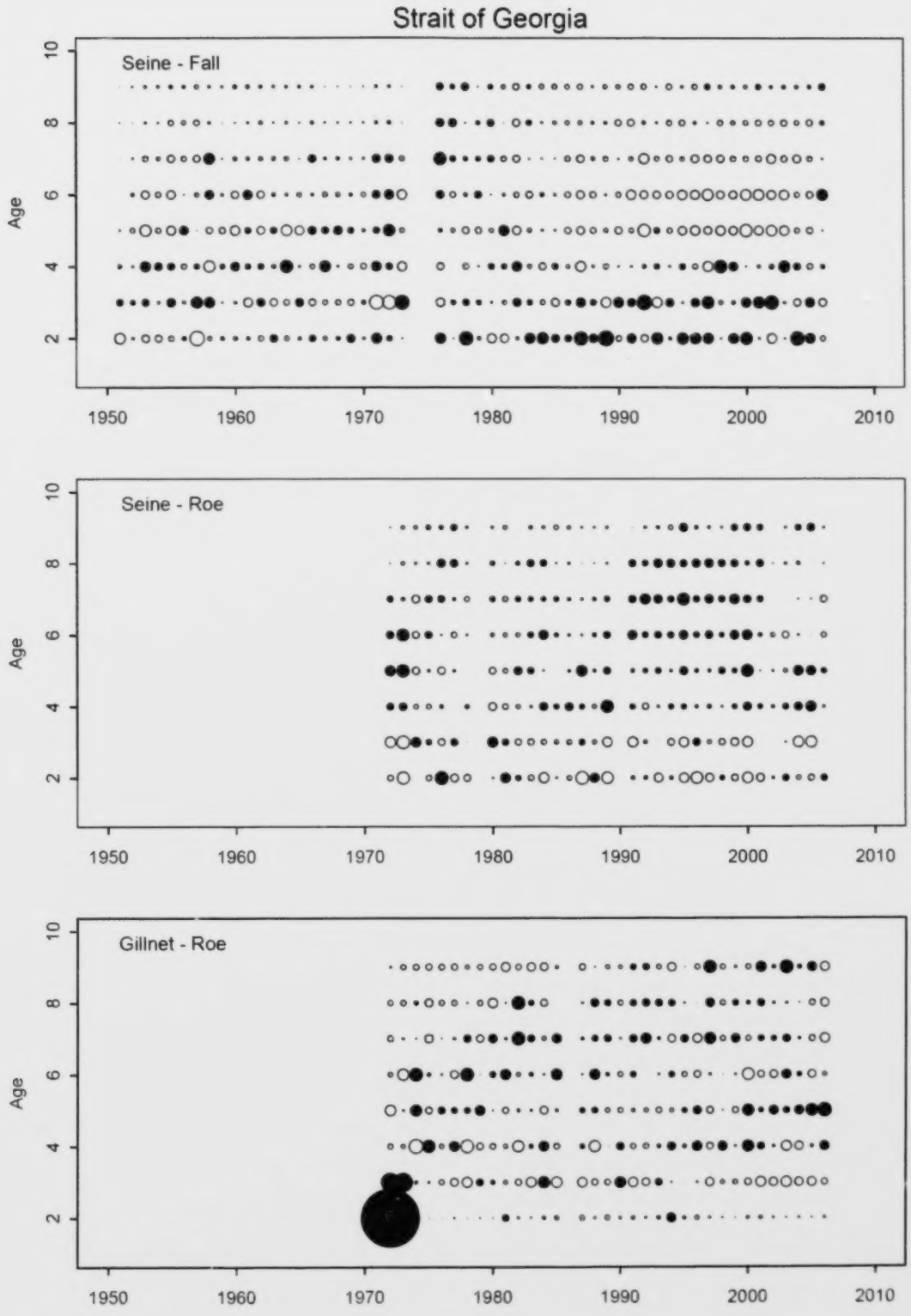


Figure 13. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the Strait of Georgia for 1951-2006. Filled circles indicate positive residuals and open circles are negative residuals.

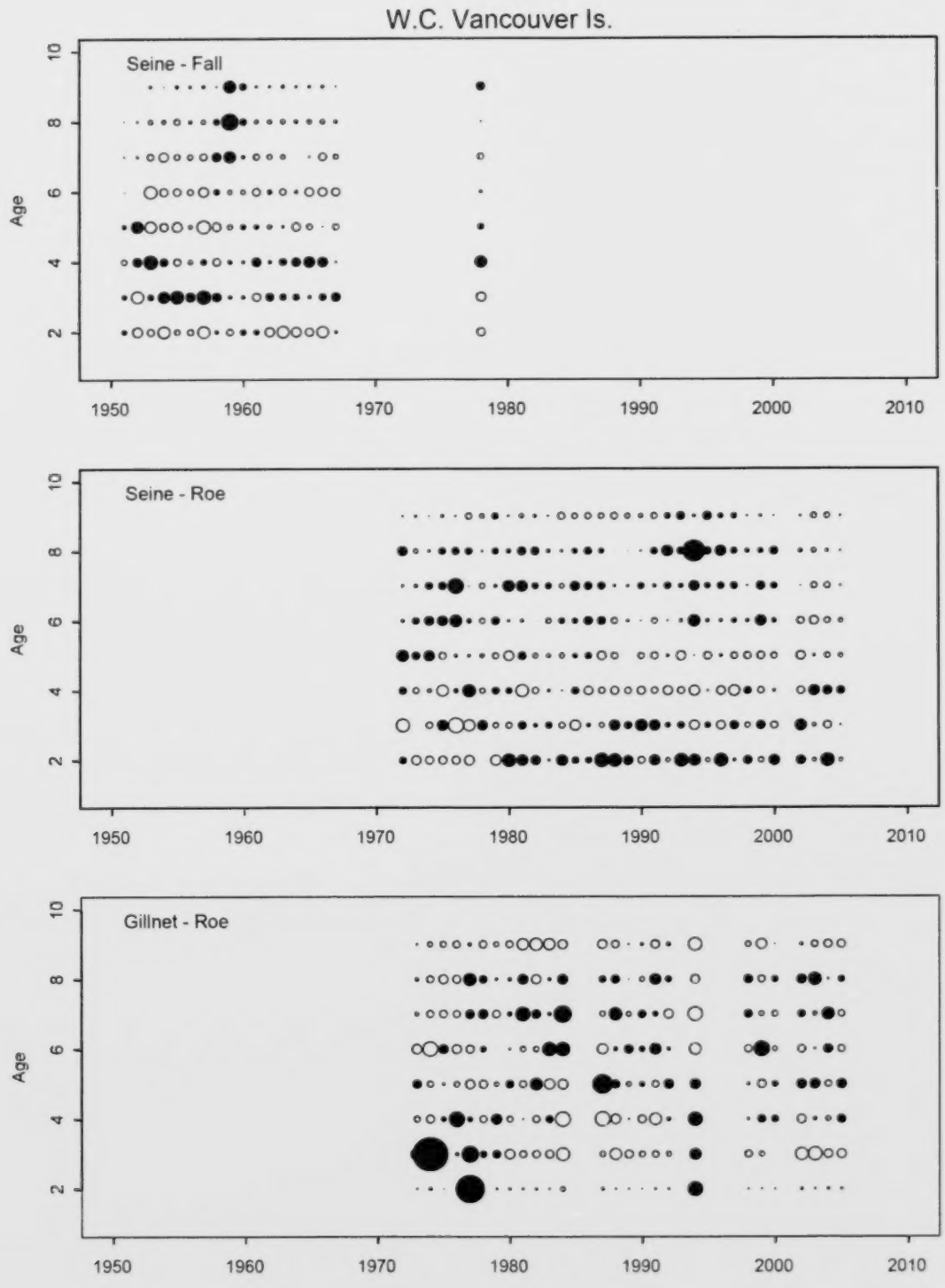


Figure 14. Residuals from the age-structured model fit to the catch-at-age data by year and fishing period for the west coast of Vancouver Island for 1951-2006. Filled circles represent positive residuals and open circles are negative residuals.

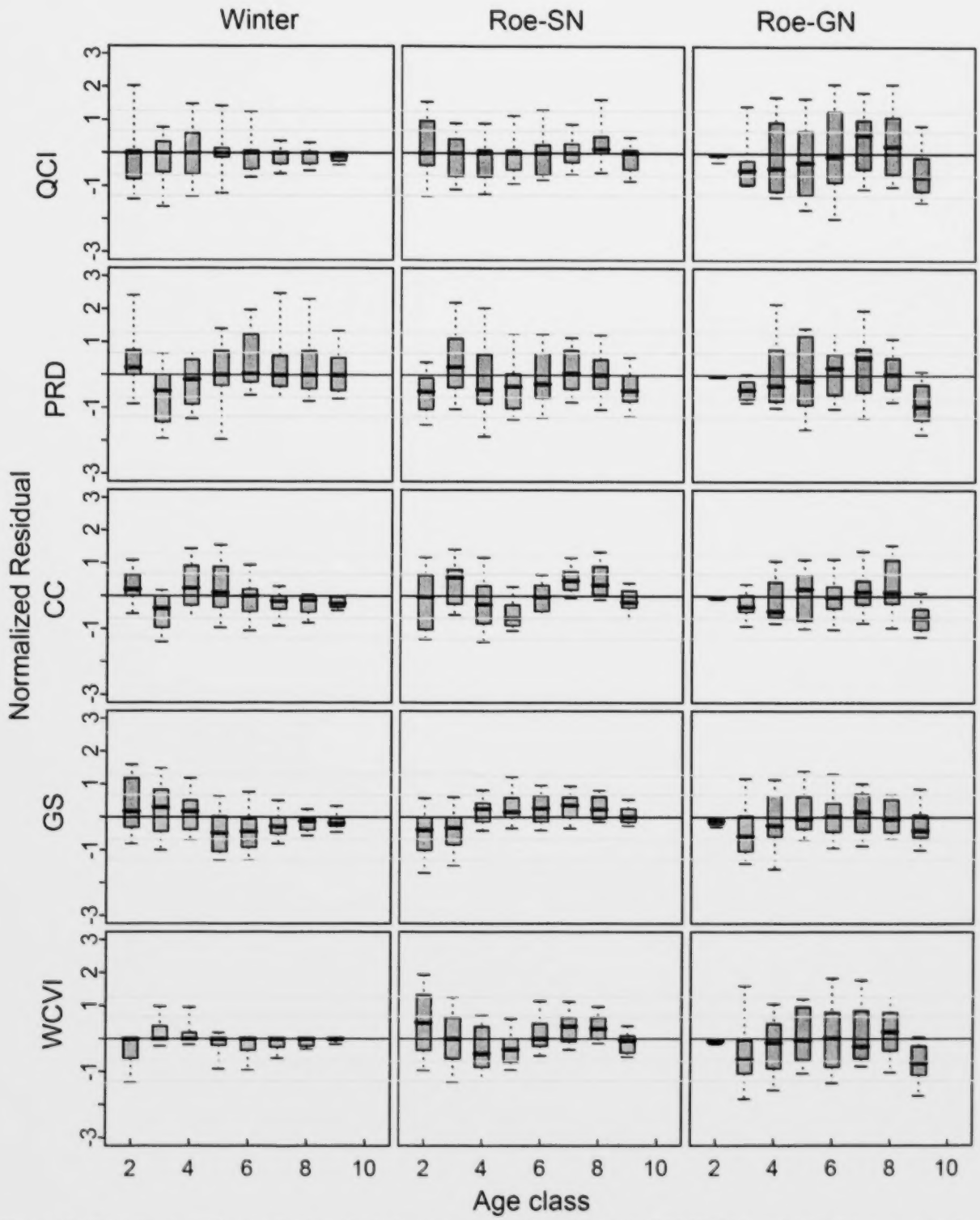


Figure 15. Quantile plots of normalized residuals from age composition fits for the R20 HCAM model, by fishery and stock. The shaded boxes show the inter-quartile range (with the median shown by the solid bar) and the whiskers show the 10th and 90th quantiles. The horizontal lines indicate the expected values for the 10th, 25th, 50th, 75th, and 90th quantiles.

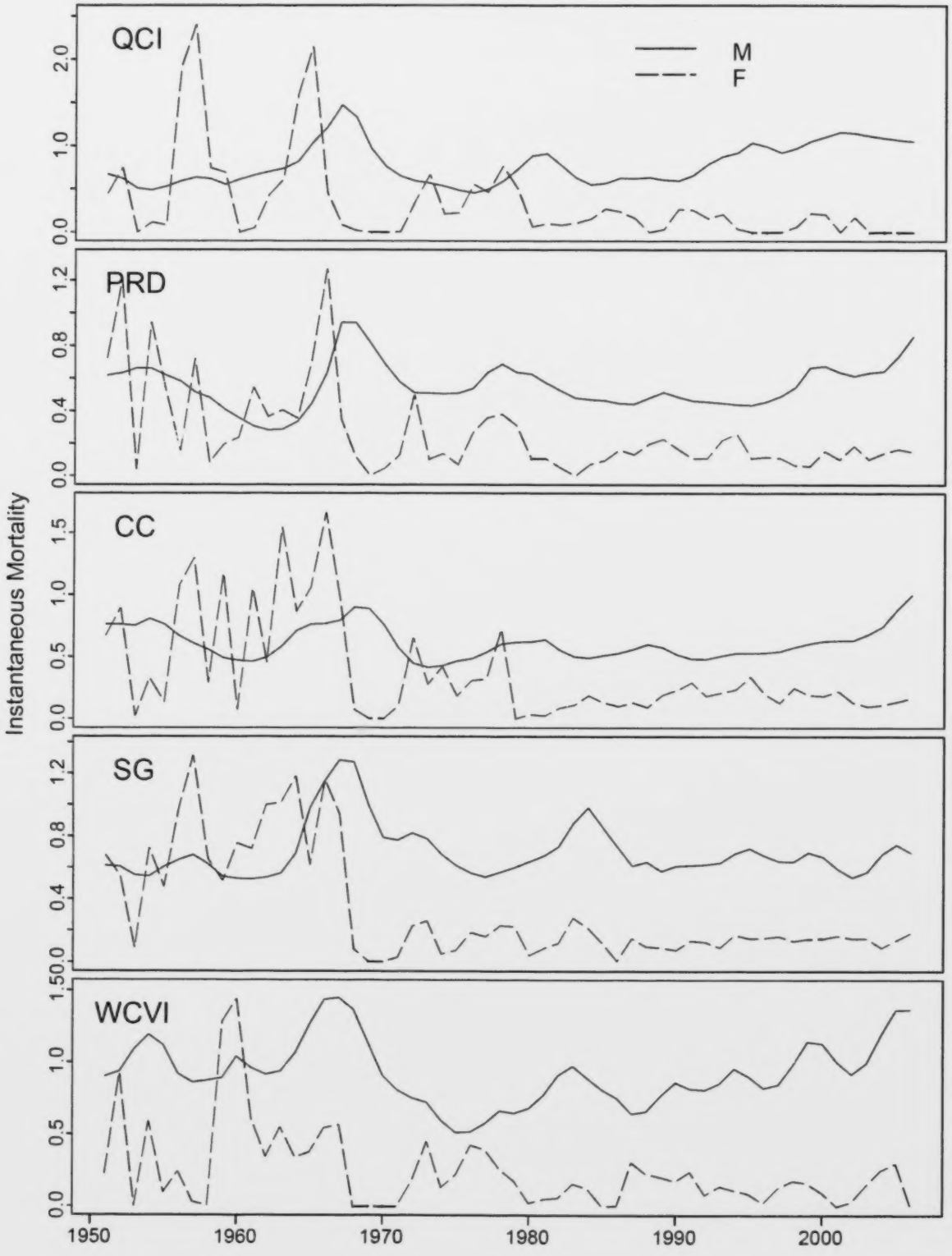


Figure 16. Estimates of annual instantaneous natural (M) and fishing (F) mortality for major B.C. herring stocks from 1951-2006.

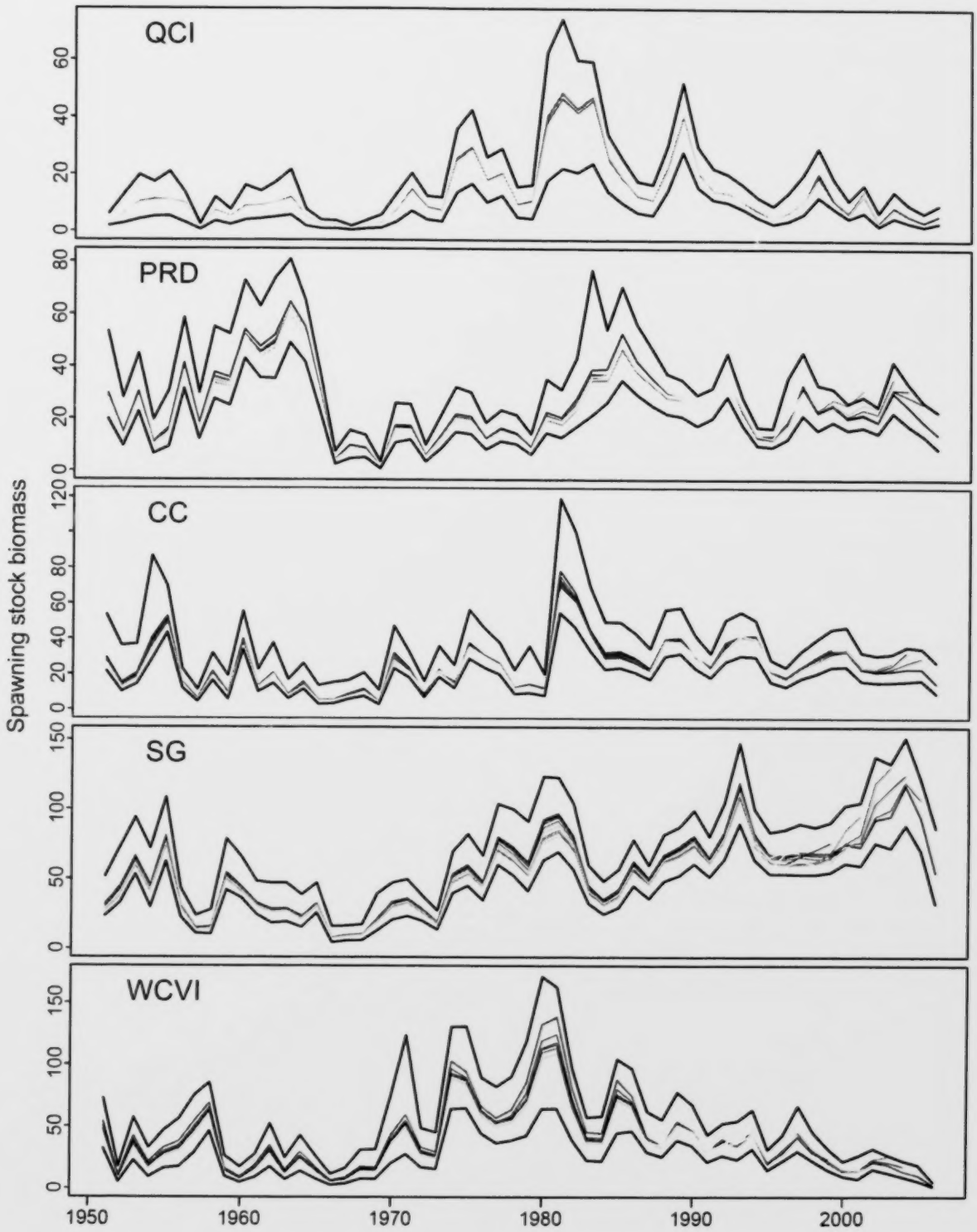
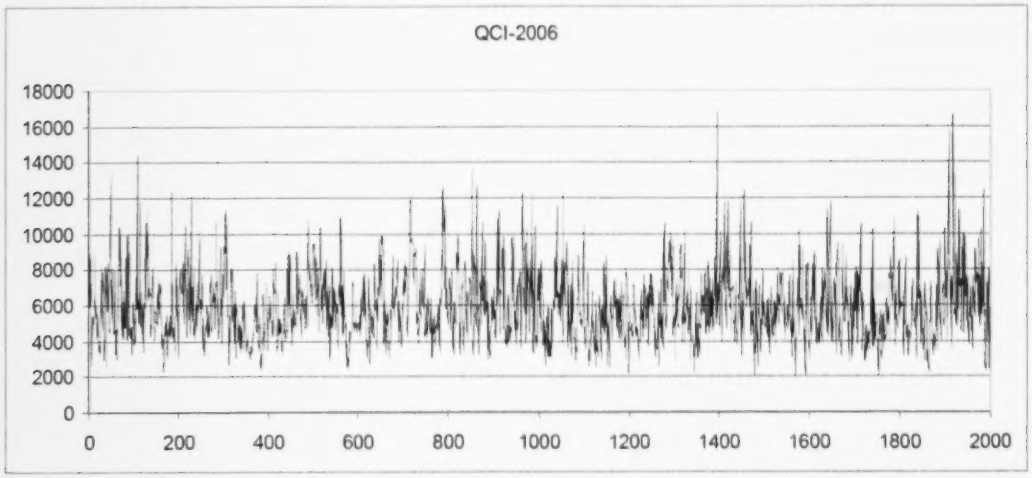
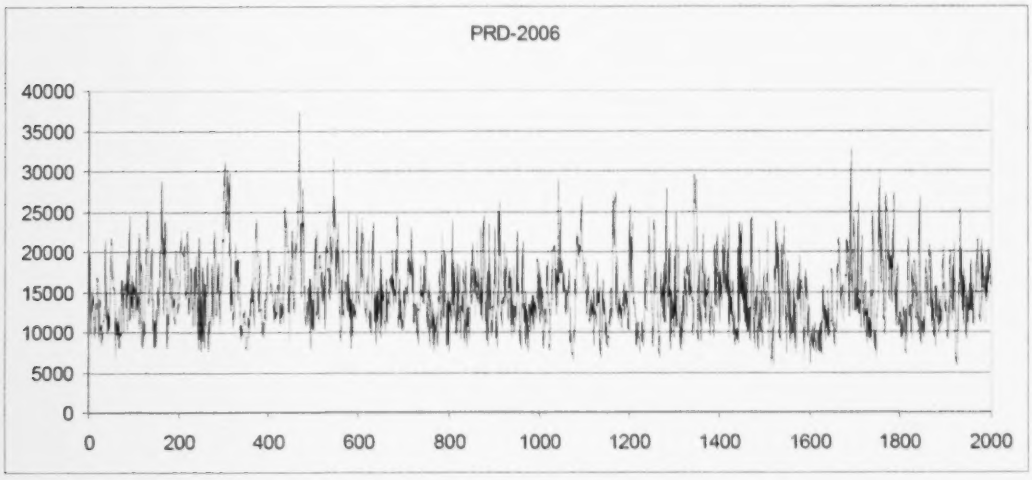
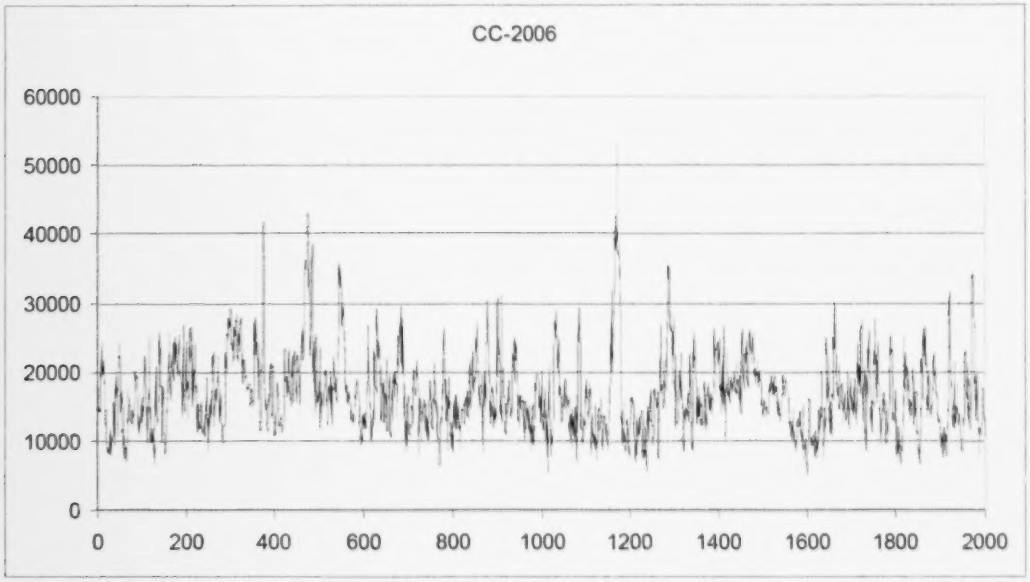


Figure 17. Estimates of spawning stock biomass from retrospective analyses (1996-2006, light coloured lines) and from marginal posterior estimates (using data through 2006, 5th and 95th percentiles of the distribution are shown as heavy lines). Results are from analyses using the R20 model parameterization.


QCI-2006
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000


PRD-2006
40000
35000
30000
25000
20000
15000
10000
5000
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000


CC-2006
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50000
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30000
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10000
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200
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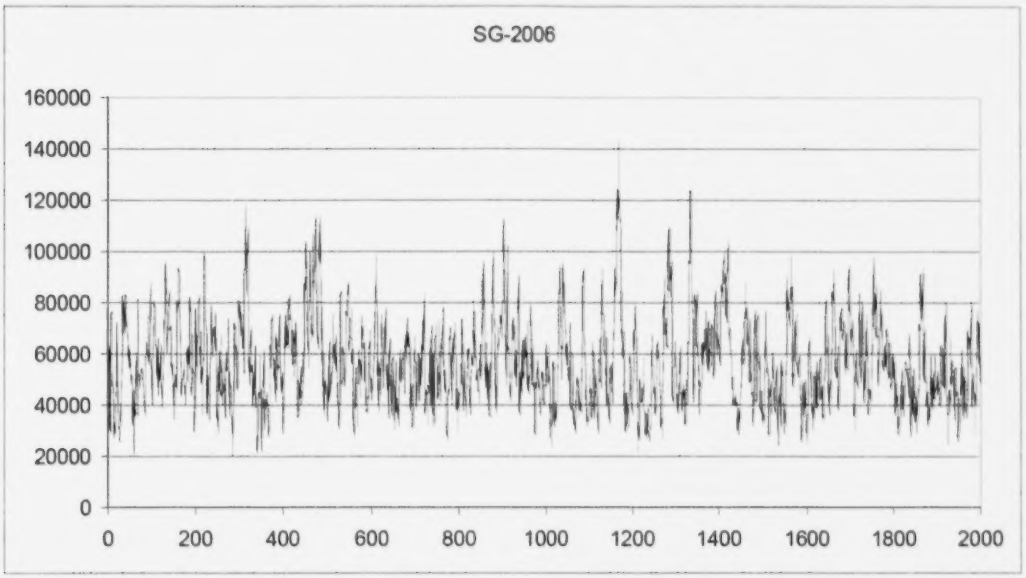
2000



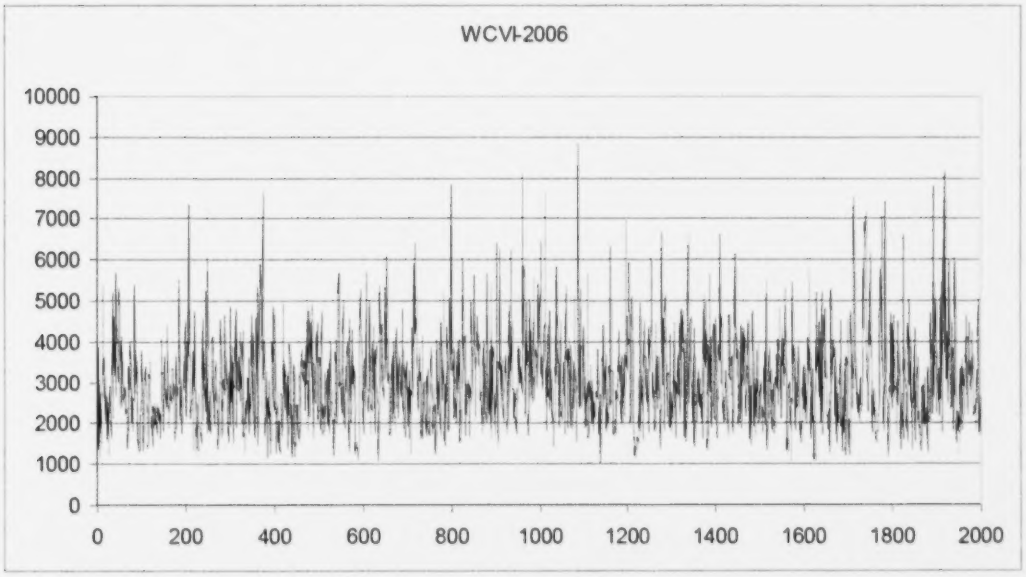


Figure 18. Trace plots from the MCMC analysis showing the sub-samples of estimated spawning biomass in 2006 for the five assessment regions.

Stock Productivity and Unfished Biomass

The productivity of a stock is directly related to the estimated steepness of the stock recruitment function at the origin. In the current implementation of the HCAM model in the Bayesian framework, an ad hoc normal prior was assumed for the steepness parameter in fitting the available data. The resulting distribution of the steepness parameter from the posterior distribution is plotted with the prior in Figure 19. Interestingly, the empirical estimates of the steepness are comparable to estimates for herring-like species found recently by Myers et al. (2002). However, further investigation with other priors should be conducted to evaluate this result.

The variance of the residuals from the stock-recruitment relationship are plotted in Figure 20 together with the assumed prior. The figures indicate good agreement between the prior and posterior distributions. The posteriors for the three northern stocks suggest recruitment variation tends to be slightly greater than assumed by the prior. For the two southern stocks the recruitment variation assumed for the prior matches the posterior more closely.

The posterior distribution of the estimate of unfished biomass (B_0) is presented in Figure 21. The estimated unfished biomass is smallest for the QCI stock with estimates considerably lower than determined previously. The estimates for the PRD and CC stocks are similar followed by the WCVI and SG. The variation around the estimate of unfished biomass is similar for the latter four stocks although the SG and WCVI suggest the greatest variability. Table 4 presents the estimated 5, 25, 50, 75, and 95th percentiles of the posterior distribution for the estimated unfished biomass. Assuming that the 50th percentile provides the best estimate of unfished biomass it is possible estimate the potential Cutoff values as 25% of the B_0. The estimates are very similar to the current values with the exception of the QCI stock which would have a substantially lower Cutoff than the current value of 10,700 mt. Although interesting, to be precautionary and given that the results are based on a new model we do not recommend revising the current Cutoff levels at this time.

Table 4. Estimates of the 5, 25, 50, 75, and 95th percentile of the posterior distribution of the unfished biomass for the five major herring stocks. The potential Cutoff level based on the 50th percentile is also presented.

Stock	5%	25%	50%	75%	95%	Potential Cutoff
QCI	10.9	14.0	16.6	19.7	25.8	4.1
PRD	35.4	41.8	46.9	52.9	62.0	11.7
CC	39.1	47.8	55.8	66.8	85.0	14.0
SG	82.6	92.7	100.0	107.7	120.8	25.0
WCVI	56.4	66.0	74.4	85.1	109.2	18.6

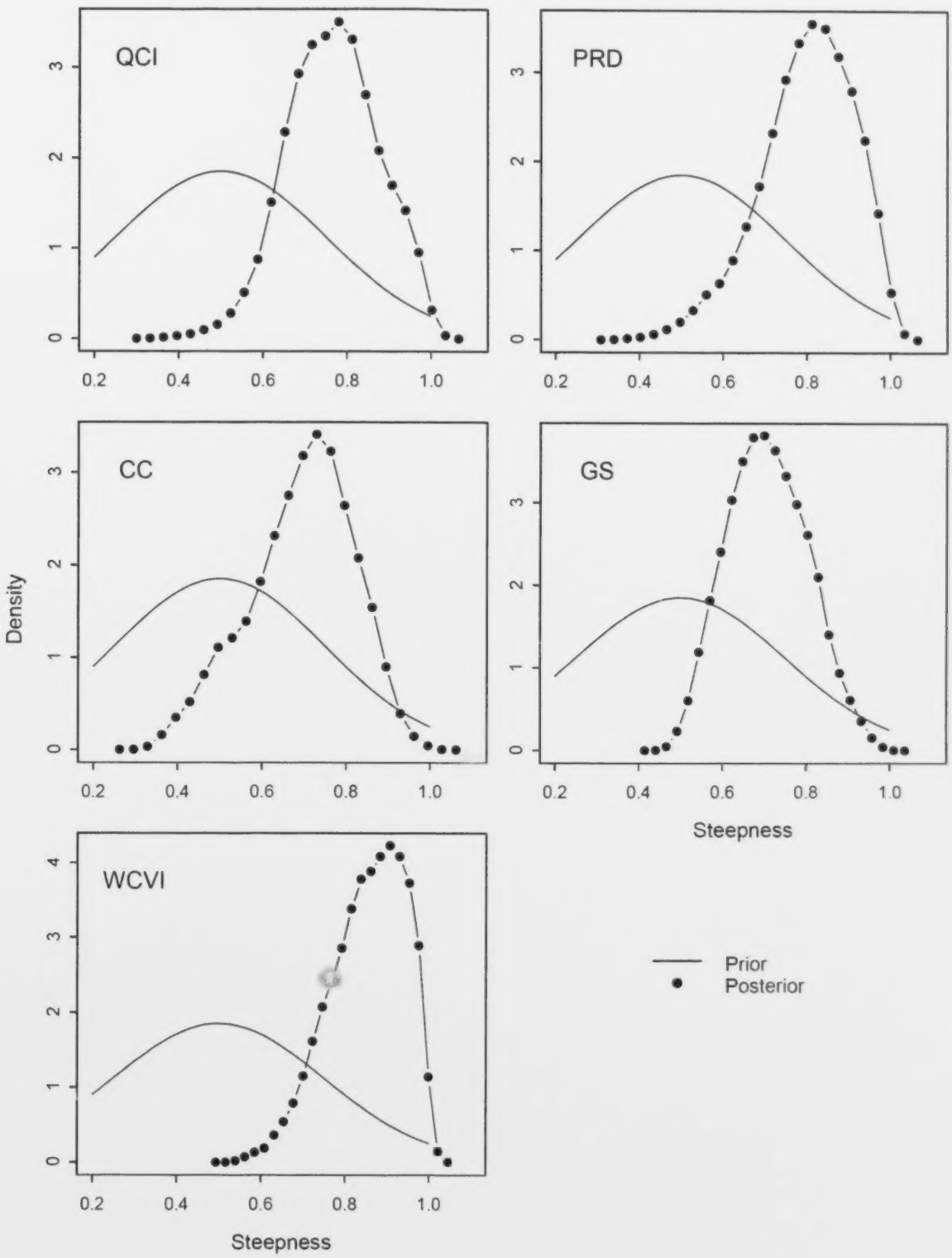


Figure 19. Bayesian prior and estimated steepness (h) from the posterior distribution for the five assessment regions.

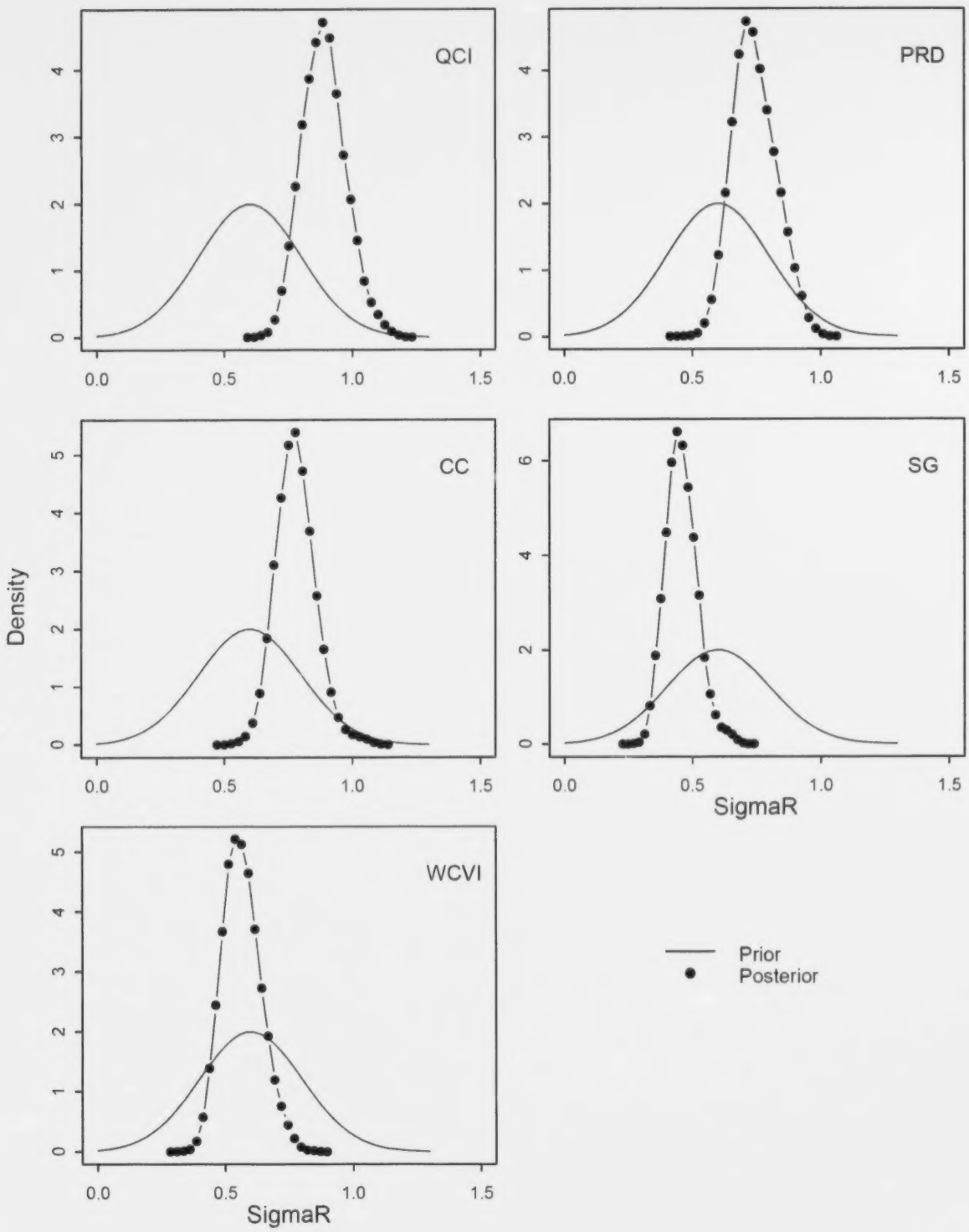


Figure 20. Bayesian prior and estimates of the variance of the stock recruitment function for the five assessment regions.

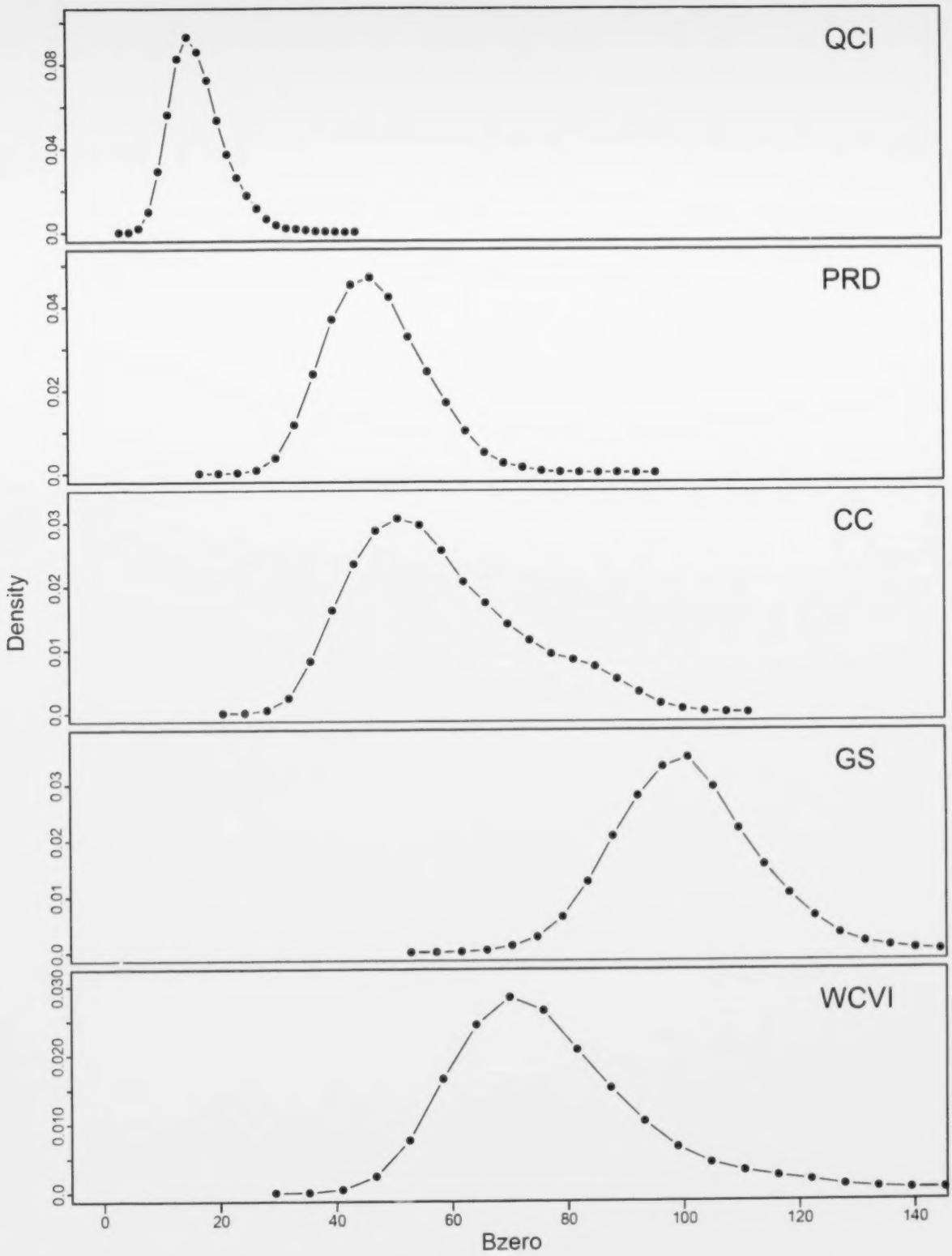


Figure 21. Bayesian distribution for the estimate of the unfished biomass (B_0) from the posterior distribution for the five assessment regions.

ABUNDANCE FORECASTS

Forecasts of pre-fishery spawning stock abundance for 2007 are calculated slightly differently than in past assessments. Forecasts of the pre-fishery biomass were determined by summing the prediction of age 4 and older biomass with the forecasts of age 2^{-} recruits for a poor, average, and good recruitment as determined from the posterior distributions of the Bayesian analysis. The results are presented in Figures 22 and 23. Poor, average, and good recruitment levels were calculated as the mean of the lowest 33%, the mid 33%, and the highest 33% of the estimates of historic age 2^{+} abundance. The calculation was conducted for each of the 1 million simulations and the distribution of forecasts is based on the sub-sample of 2000 traces from the MCMC analysis.

Queen Charlotte Islands

The posterior distribution for the estimate of 2006 spawning biomass is presented in Figure 22 and suggests abundance of about 5000 tonnes. The distribution of forecast biomass with poor and average recruitment indicates that abundance will be similar in 2007. A good recruitment in 2007 could increase biomass to 10-15,000 tonnes bringing the stock above the Cutoff level (Figure 22). Recruitment to this stock has been generally poor for the past decade (Fig. 24) with good year-classes occurring in 1995 and 2000. The 2001 through 2003 year-classes have been poor or average. The spawning run was composed primarily of age 3^{-} fish from the 2002 year-class constituting 43% of the spawners while age 6^{-} fish from the 2000 year-class contributed another 15% of the run (Appendix 1.1). The forecast with a poor recruitment is 5,000 tonnes and 6,800 tonnes with an average recruitment (Table 5).

Prince Rupert District

The posterior distribution from the MCMC simulation indicates that the spawning biomass in 2006 was slightly less than 15,000 tonnes (Fig. 22). The distributions of forecast biomass with both poor and average recruitment will retain abundance at similar levels just above the Cutoff of 12,100 tonnes for this assessment region. A good recruitment would increase abundance to well above 20,000 tonnes. Recruitment to this stock has been consistent, with good year-classes occurring roughly every few years since 1980 (Figure 24). Both the 2000 and 2002 year-classes were good but the 2001 and the 2003 year-class that recruited in 2006 were poor. The spawning run consisted of about 16% age 2^{-} recruits with the majority of the run (44%) comprised of age 3^{-} fish from the 2002 year-class with another 23% age 5^{-} fish from the 2000 year-class (Appendix 1.2). The forecast run size to the Prince Rupert District in 2007 with poor recruitment is 15,400 tonnes and with average recruitment 19,100 tonnes (Table 5).

Central Coast

The estimate of the 2006 spawning biomass and 2007 pre-fishery forecasts are presented in Figure 22. The posterior distribution indicates that spawning abundance in 2006 was about 15,000 tonnes. The forecast for 2007 with poor recruitment would result in a similar level of abundance. An average recruitment would result in run size of just over 20,000 tonnes whereas a good recruitment would increase abundance above 30,000 tonnes. The projected abundance with an average recruitment would leave the stock just above the Cutoff of 17,600 tonnes for this assessment region. Recruitment to this stock has been characterized by intermittent strong year-classes with the most recent one being the 2002 (54% of the 2006 run) that recruited in 2005 (Fig. 24). The other strong year-class was 2000, still accounting for 20% of the spawning run at age 5^{-} while the recruiting 2003 year-class is poor and constituted only 10% of the run in 2006 (Appendix 1.3). The forecast run size to the Central Coast in 2007 with poor recruitment is 17,500 tonnes and with average recruitment is 21,700 tonnes (Table 5).

Strait of Georgia

The Strait of Georgia herring stock remains the most productive on the coast. The posterior distribution of the 2006 spawning biomass and the pre-fishery forecasts for 2007 is presented in Figure 23. The 2006 biomass was just over 50,000 tonnes and a similar level is projected in 2007 with a poor recruitment. An average recruitment would produce a run of just over 70,000 tonnes while a good recruitment would return the stock to almost 100,000 tonnes. Although abundance declined substantially in 2006 the stock remains well above the Cutoff of 21,200 tonnes for this assessment region. Recruitment to this stock has been characterized by consistent strong year-classes every second or third year since the mid-1980s (Fig. 25). The recent year-classes from 1998-2002 are among the largest ever observed in this assessment region. The 2000 through 2003 year-classes contributed 11, 19, 24, and 25% of the 2006 run, respectively. A substantial proportion of the run (17%) was also comprised of age 1^{-} spawners (Appendix 1.4). The forecast run size to the Strait of Georgia in 2007 with a poor recruitment is 57,100 and with average recruitment is 73,200 tonnes (Table 5).

West Coast Vancouver Island

Abundance in the west coast of Vancouver Island assessment region has fluctuated dramatically from the historic high of the mid-1970s to the recent depressed levels (Fig. 7). The posterior distribution form the MCMC simulation indicates that the spawning biomass in 2006 was below 5,000 tonnes, a level not seen since the collapse of the late 1960s although the stock has been only lightly fished during the past decade (Figure 23). The forecast pre-fishery abundance for 2007 indicates that even a poor recruitment should double current levels to at least 10,000 tonnes. An average recruitment would increase abundance to around 20,000 tonnes just above the Cutoff of 18,800 tonnes for this assessment region. A good recruitment would increase abundance to above 30,000 tonnes but this is very poorly determined (Figure 23). Recruitment to this stock has been characterized by periods of good and bad recruitment prior to 1980. Subsequently, average or better year-classes have been intermittent occurring about every 4-5 years (Fig. 25). The majority of the 2006 run was comprised of only two year-classes (Appendix Table 1.5). The 2002 year-class contributed 34% while the recruiting 2003 year-class, while poor, contributed 37%. There was also an unusual abundance of precocious 1+ spawners (15%). The forecast run size to the west coast of Vancouver Island in 2007 with a poor recruitment is 13,100 tonnes and with an average recruitment is 20,600 tonnes (Table 5).

Table 5. Estimated 50th percentiles of the posterior distributions from Bayesian analysis of 2006 spawning biomass and forecasts of the 2007 pre-fishery biomass with poor, average, and good recruitment.

			Forecast Biomass			Available Harvest		
	2006 SB	2007 – 4+	Poor	Avg	Good	Poor	Avg	Good
QCI	5651	4132	5004	6820	12638	0	0	1938
PRD	14161	13936	15384	19126	28293	3077	3825	5659
CC	15893	15125	17549	21683	32643	0	4083*	6529
SG	53975	40111	57125	73224	91468	11425	14645	18294
WCVI	2850	6970	13116	20612	38486	0	1812*	7697

* Harvest level is Forecast*0.2 minus Cutoff

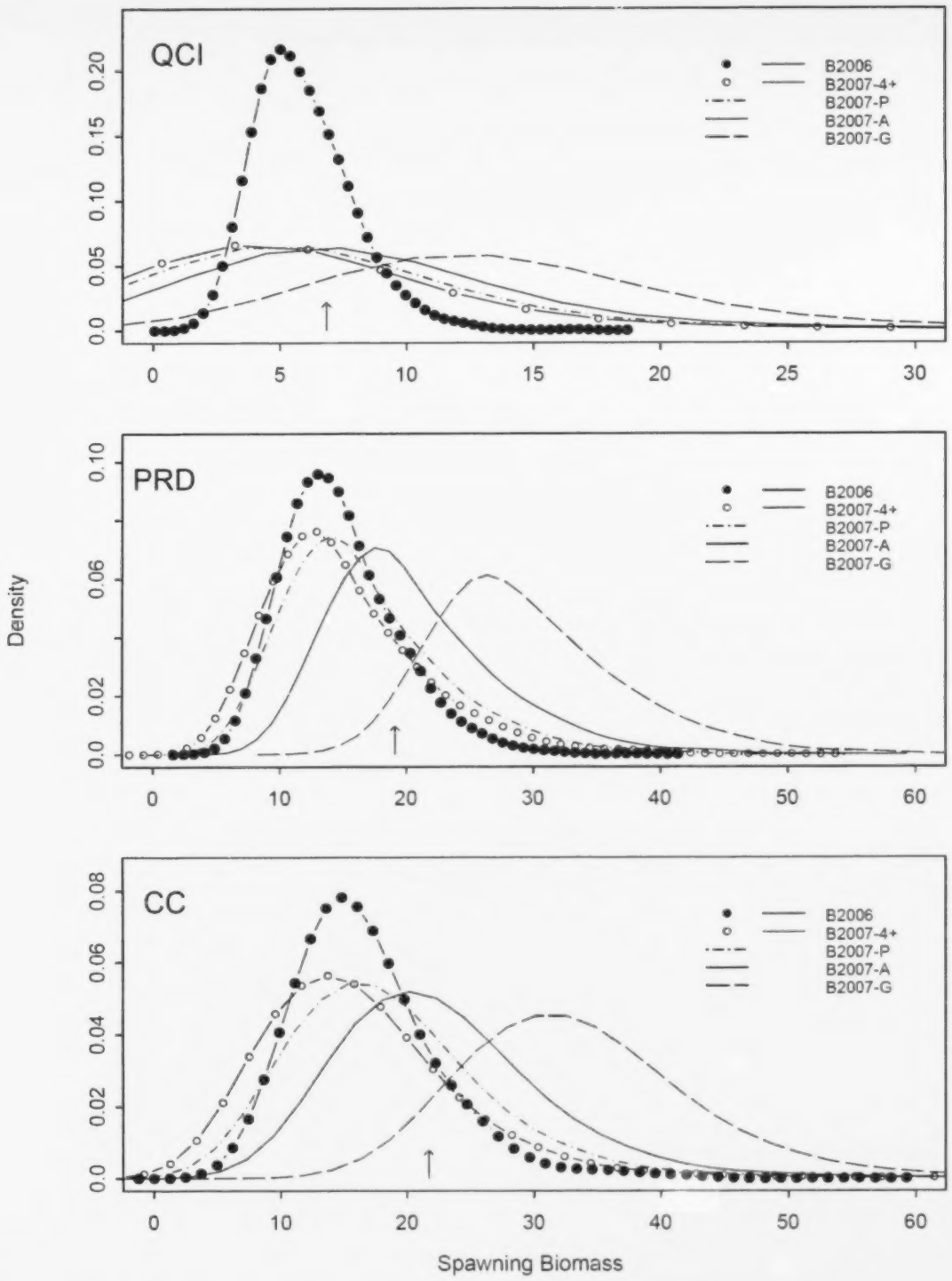


Figure 22. Estimated Markov chain Monte Carlo (MCMC) Bayesian profile likelihood distributions for spawning biomasss in 2006 and the forecast pre-fishery biomass in 2007 for the northern stock assessment regions. Arrow represents the 50th percentile of the forecast assuming an average recruitment.

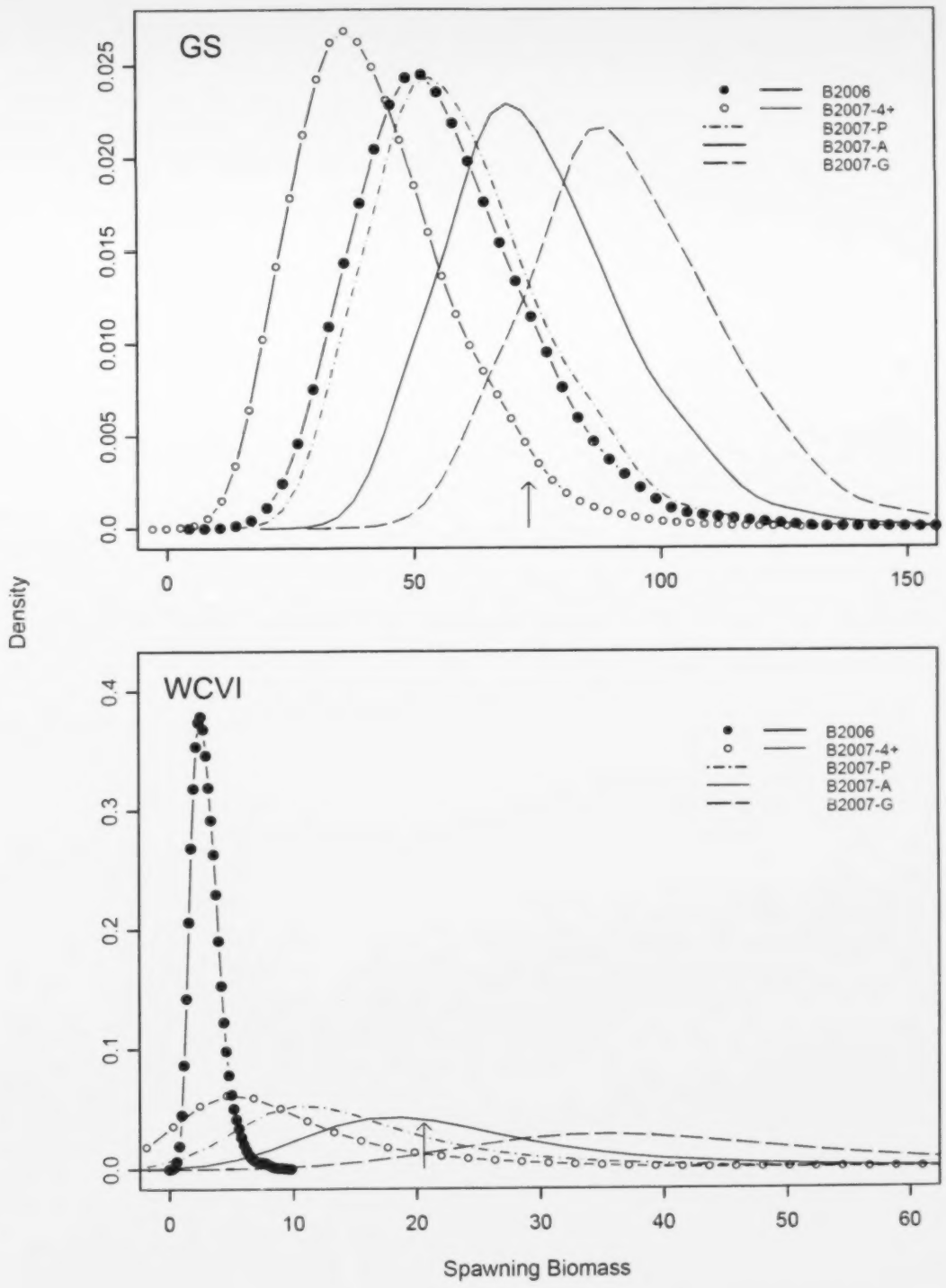


Figure 23. Estimated Markov chain Monte Carlo (MCMC) Bayesian profile likelihood distributions for the 2006 spawning biomass and the forecast pre-fishery biomass for 2007 for the southern stock assessment regions. Arrow represents the 50th percentile of the forecast assuming an average recruitment.

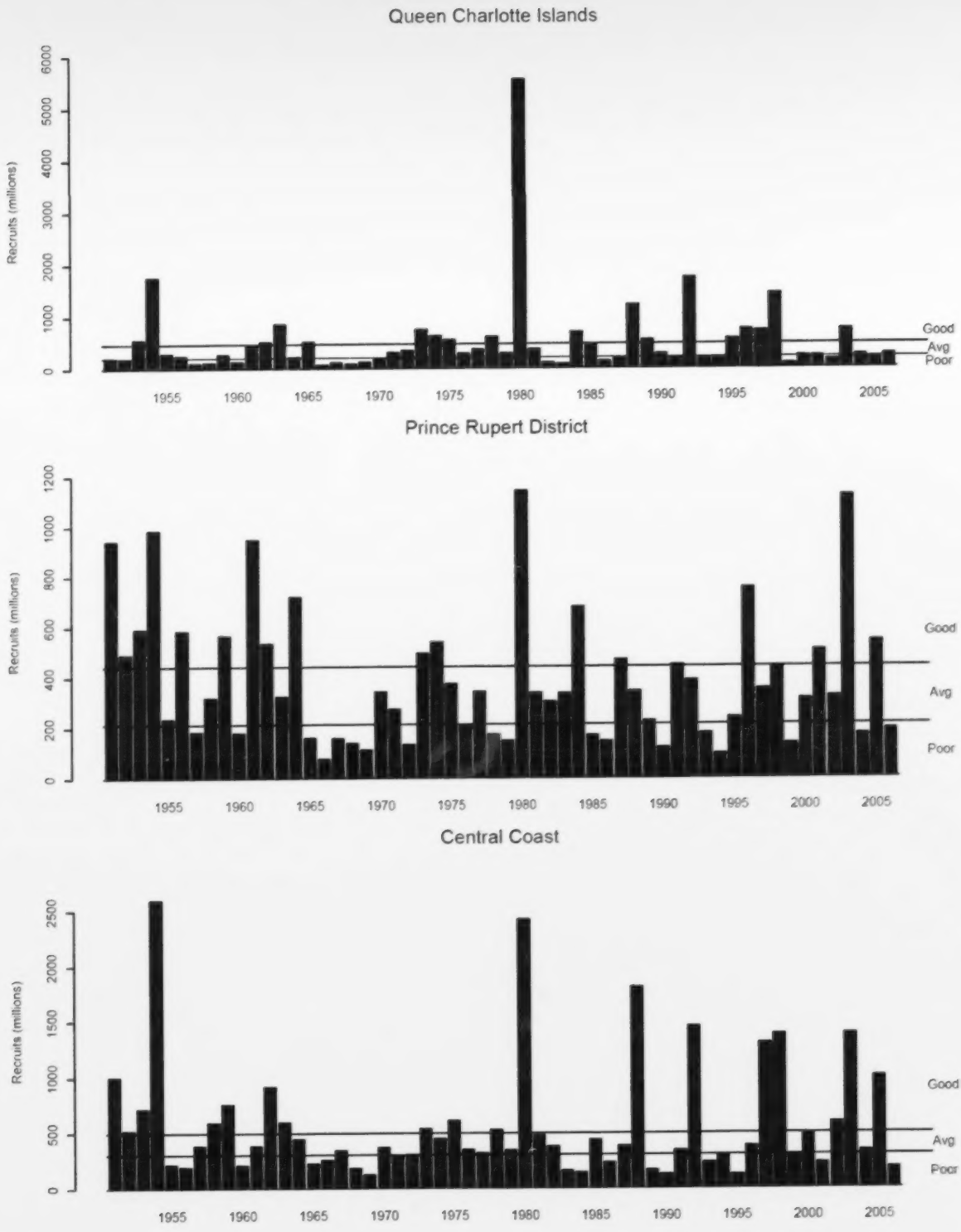


Figure 24. Estimates of abundance of recruiting age 2^{+} year-classes from age-structured analysis for northern B.C. herring stock assessment regions, 1951-2006. The horizontal lines delimit poor, average, and good recruitment categories and are the 33 and 66 percentiles of the cumulative frequency distribution.

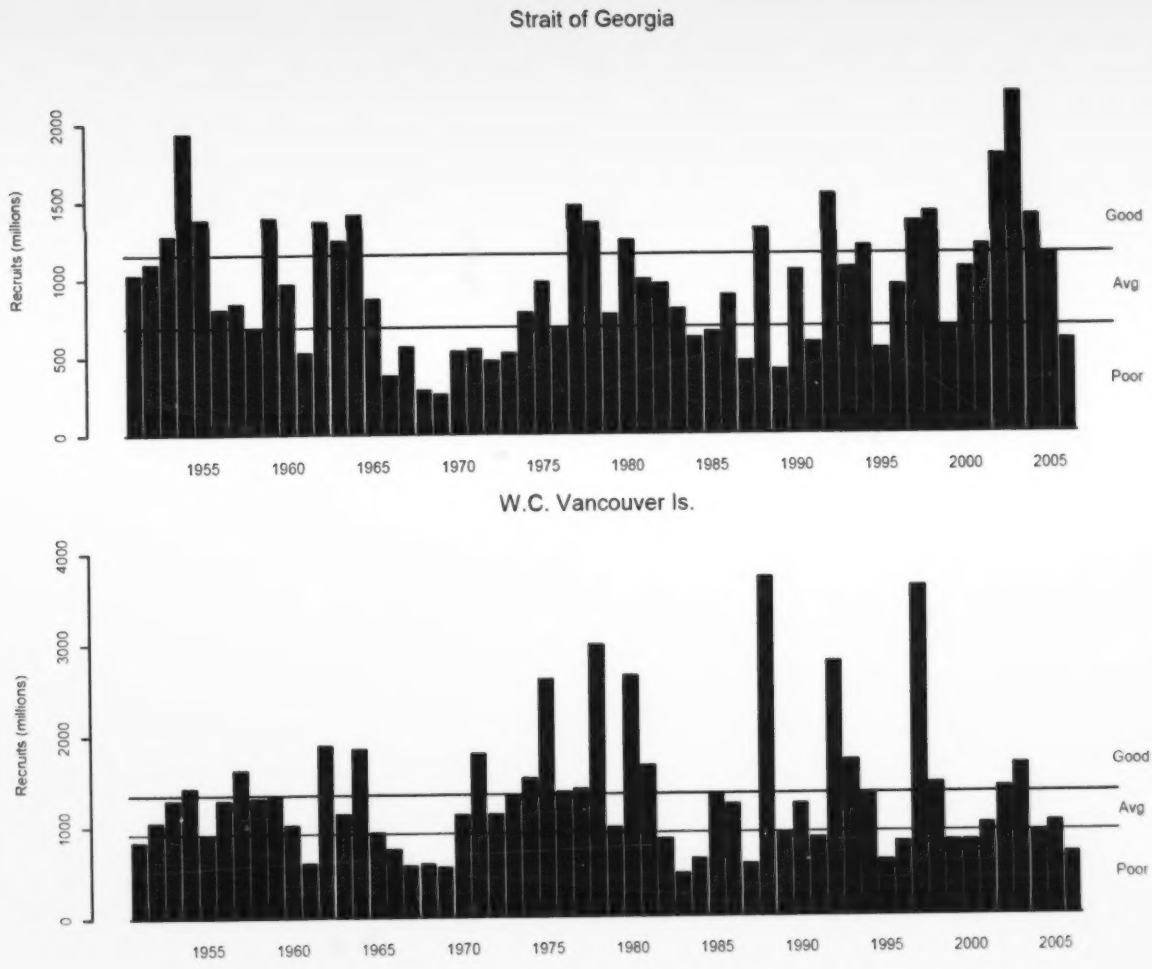


Figure 25. Estimates of abundance of recruiting age 2^+ year-classes from age-structured analysis for southern B.C. herring stock assessment regions, 1951-2006. The horizontal lines delimit poor, average, and good recruitment categories and are the 33 and 66 percentiles of the cumulative frequency distribution.

MINOR STOCKS – AREA 27 & 2W

Abundance estimates for the minor herring stocks in Areas 2W and 27 were obtained using the HCAM assessment model. The version of the model used was R18 as described earlier in the document. Because of data limitations for these two stocks it was not possible to obtain estimates with the preferred model R20. In addition, the model was run for shorter time periods for these two stocks. Given the novelty of this approach and the patchiness of the data we continue to recommend a harvest rate of 10% of the forecast biomass for these two stocks rather than 10% of the estimate of current biomass as was the policy in the past.

Area 27

The availability of consistent age structure and spawn deposition data for this stock began in the late 1970s. Some limited biological sampling data was available in the early 1970s but usually consisted of a single sample and was insufficient for catch-age analysis. As a result, the HCAM analysis for this stock was begun in 1977/78 to present. The available information on catch and spawning biomass as estimated from the escapement model is presented in Table 7. The HCAM analysis for this stock is consistent and fits the spawn deposition data closely suggesting a spawning biomass ranging between 1-5,000 tonnes (Figure 26). The lowest level occurred in 2001 and the stock has been increasing slowly since then. The forecast biomass for 2007 based on the HCAM model and assuming an average recruitment is 2651 tonnes (Table 6).

Area 2W

The availability of relatively consistent age structure and spawn deposition estimates for this stock began in 1972/73. Unfortunately, there was also a period from 1995-1997 when no biological samples were collected. The time series of available catch and spawn deposition data are presented in Table 8 as in previous assessments with spawning biomass determined using the escapement model. The estimate of spawning biomass for the available data suggests a stock varying between 4,000 to 10,000 tonnes from the early 1970s to the early 1990s (Figure 26) . The limited spawn survey coverage and absence of age structure data through the mid-1990s make it difficult to determine stock size and the model fits closely to the available spawn estimates. The more recent spawn surveys and biological sampling data suggest a stock size approaching 2,000 tonnes. The forecast biomass for the stock in Area 2W based on the HCAM model and assuming an average recruitment is 3864 tonnes (Table 6).

Table 6. Forecasts of the 2007 biomass for the minor stocks in Areas 27 and 2W assuming poor, average, and good recruitment.

			Forecast Biomass			Available Harvest*		
	2006 SB	2007 – 4+	Poor	Avg	Good	Poor	Avg	Good
Area 27	2087	2035	2517	2651	3646	252	265	365
Area 2W	2076	3599	3670	3864	6032	367	386	603

*Assumes a 10% harvest rate.

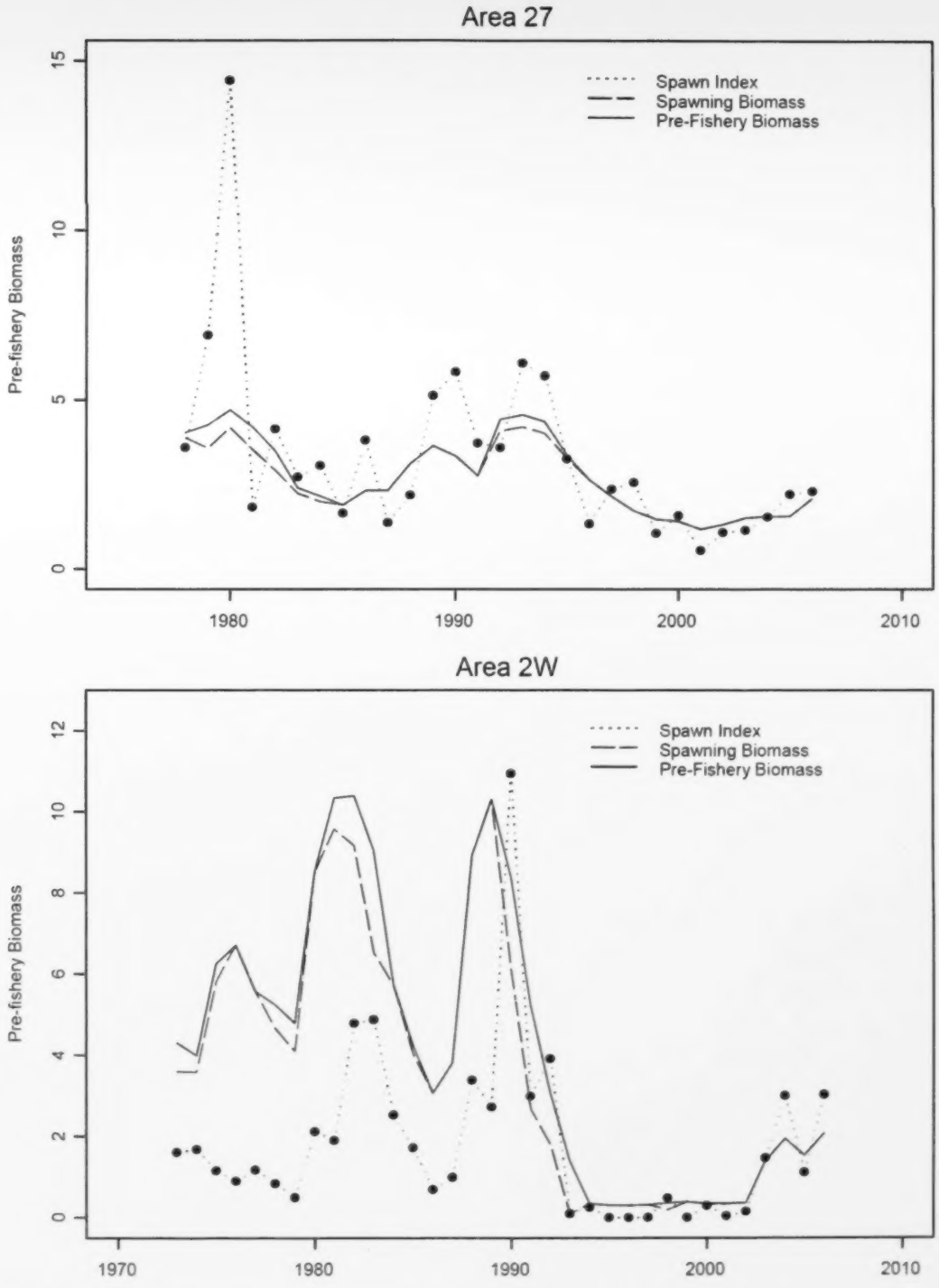


Figure 26. Estimated pre-fishery biomass for the minor stocks in Area 27 and Area 2W.

Table 7. Estimates of spawning stock biomass, catch, and pre-fishery stock abundance (tonnes) for the minor stock in area 27 for 1951-2006.

	Spawn (mt)				Catch (mt)				Total
Season	Surface	Macro	Dive	Total	Seine	Gillnet	Other	Total	Stock
19501	1,955.24			1,955.24					1,955.24
19512	484.38			484.38					484.38
19523	4,618.03			4,618.03					4,618.03
19534	2,646.44			2,646.44	1,919.89			1,919.89	4,566.33
19545	574.87			574.87	5,938.70			5,938.70	6,513.58
19556	1.47			1.47					1.47
19567	184.03			184.03					184.03
19578	38.62			38.62					38.62
19589	60.47			60.47	407.22			407.22	467.69
19590	223.95			223.95					223.95
19601	168.99			168.99	1,149.06			1,149.06	1,318.05
19612	101.62			101.62	173.05			173.05	274.67
19623	407.30			407.30	30.75			30.75	438.05
19634	0.00			0.00	322.55			322.55	322.55
19645	2,516.54			2,516.54	769.08			769.08	3,285.62
19656	81.73			81.73	951.48			951.48	1,033.21
19667	46.24			46.24	51.42			51.42	97.66
19678	141.68			141.68					141.68
19689T	2,198.42			2,198.42					2,198.42
19690	2,433.72			2,433.72					2,433.72
19701	290.00			290.00					290.00
19712	250.29			250.29					250.29
19723	2,578.17			2,578.17					2,578.17
19734	0.00			0.00	507.91	18.33		526.25	526.25
19745	1,606.18			1,606.18					1,606.18
19756	210.44			210.44		78.62		78.62	289.06
19767	638.19		0.00	638.19					638.19
19778	3,595.03			3,595.03	74.98	75.12	0.00	150.10	3,745.13
19789	6,908.61			6,908.61	422.13	270.40	0.00	692.53	7,601.13
19790	14,419.06			14,419.06		519.26	0.00	519.26	14,938.32
19801	1,828.32			1,828.32		670.95	0.00	670.95	2,499.27
19812	4,136.53			4,136.53	238.49	332.09	0.00	570.58	4,707.11
19823	2,500.47			2,500.47		162.93	0.00	162.93	2,663.41
19834	3,004.22			3,004.22		170.71	0.00	170.71	3,174.93
19845	370.26		1011.75	1,382.00			0.00	0.00	1,382.00
19856	47.10	284.64	3,162.95	3,494.69			0.00	0.00	3,494.69
19867	952.33			952.33			0.00	0.00	952.33
19878	1,612.23			1,612.23			0.00	0.00	1,612.23
19889	1,684.74	122.10	2,804.86	4,611.70			0.00	0.00	4,611.70
19890	3,565.45	37.96	1,608.78	5,212.19			0.00	0.00	5,212.19
19901	2,011.68	11.15	1,190.53	3,213.37	0.09		0.00	0.09	3,213.46
19912	55.30	613.94	2,109.40	2,778.64	335.43		0.00	335.43	3,114.07
19923	1,394.34	2,536.51	1,645.78	5,576.63		366.85	0.00	366.85	5,943.49
19934		1,967.85	3,260.94	5,228.78		344.55	0.00	344.55	5,573.33
19945		559.20	1,924.89	2,484.09	87.57		0.01	87.58	2,571.67
19956		14.41	1,319.05	1,333.46			0.02	0.02	1,333.48
19967		61.77	1,901.13	1,962.90			0.00	0.00	1,962.90
19978		214.65	1,940.96	2,155.61			0.00	0.00	2,155.61
19989		153.05	504.40	657.46			0.00	0.00	657.46
19990			1,300.92	1,300.92			0.00	0.00	1,300.92
20001			220.49	220.49			0.00	0.00	220.49
20012		100.68	816.48	917.16			0.00	0.00	917.16
20023		140.56	765.21	905.77			0.00	0.00	905.77
20034		230.06	923.83	1,153.89			0.00	0.00	1,153.89
20045		178.70	1618.23	1,796.93			0.00	0.00	1,796.93
20056			511.29	1,936.28			0.00	0.00	1,936.28

Table 8. Estimates of spawning stock biomass, catch, and pre-fishery stock abundance (tonnes) for the minor stock in area 2W for 1951 to 2006.

	Spawn (mt)				Catch (mt)				Total
Season	Surface	Macro	Dive	Total	Seine	Gillnet	Other	Total	Stock
19523	202.90			202.90					202.90
19567	3.82			3.82	105.83			105.83	109.65
19578	156.88			156.88					156.88
19589	1,915.96			1,915.96					1,915.96
19590	1,569.27			1,569.27					1,569.27
19601	558.49			558.49					558.49
19612	1,715.31			1,715.31					1,715.31
19623	1,436.26			1,436.26					1,436.26
19634	968.87			968.87	312.49			312.49	1,281.35
19645	439.48			439.48	1,251.27			1,251.27	1,690.75
19656	23.51			23.51	172.37			172.37	195.87
19667	261.65			261.65					261.65
19678	72.62			72.62					72.62
19689	593.04			593.04					593.04
19690	576.86			576.86					576.86
19701	603.53			603.53					603.53
19712	1,010.77			1,010.77					1,010.77
19723	1,603.60			1,603.60	705.73			705.73	2,309.33
19734	1,674.84			1,674.84	403.25			403.25	2,078.09
19745	1,153.98			1,153.98	449.34			449.34	1,603.31
19756	826.10			826.10					826.10
19767	1,174.40			1,174.40				0.00	1,174.40
19778	831.97			831.97	574.68			574.68	1,406.66
19789	494.02			494.02	690.59			690.59	1,184.61
19790	2,114.38			2,114.38					2,114.38
19801	1,811.18			1,811.18	770.26			770.26	2,581.44
19812	4,781.24			4,781.24	1,225.32			1,225.32	6,006.56
19823	4,869.26			4,869.26	2,518.17			2,518.17	7,387.44
19834	2,522.18			2,522.18					2,522.18
19845	1,719.33			1,719.33	199.47			199.47	1,918.80
19856	683.72			683.72					683.72
19867	988.92			988.92					988.92
19878	3,380.16			3,380.16					3,380.16
19889	2,718.92			2,718.92					2,718.92
19890	2,787.76		8,157.95	10,945.72	2,271.92			2,271.92	13,217.64
19901	355.53	170.74	2,459.14	2,985.41	2,558.29			2,558.29	5,543.70
19912		169.14	3,740.13	3,909.28	1,283.54			1,283.54	5,192.62
19923	0.61	12.54	76.16	89.31	1,305.66			1,305.66	1,394.98
19934		17.13	231.10	248.24					248.24
19978		13.70	455.21	468.91	179.63			179.63	648.53
19990		145.60	142.79	288.39					288.39
20001			34.58	34.58					34.58
20012		13.39	135.89	149.28					149.28
20023	1,461.95			1,461.95					1,461.95
20034	10.94	345.16	2,639.56	2,995.66					2,995.66
20045	226.33	18.08	330.69	575.09					575.09
20056	3,021.64			3,021.64					3,021.64

POTENTIAL HARVESTABLE

The Pacific Science Advice Review Committee (PSARC) has reviewed the biological basis for target exploitation rate, considering both the priority of assuring conservation of the resource and allowing sustainable harvesting opportunities (Schweigert and Ware 1995). The review concluded that 20% is an appropriate exploitation rate for those stocks that are well above Cutoff or minimum spawning biomass threshold levels (PSARC 1995). The 20% harvest rate is based on an analysis of stock dynamics which indicates this level will stabilize both catch and spawning biomass while foregoing minimum yield over the long term (Hall et al. 1988, Zheng et al. 1993). In addition to the 20% harvest rate, a Cutoff level set at 25% of the estimated unfished biomass level is used to ensure that adequate spawning biomass to sustain each population during natural reductions in abundant stock productivity, is maintained for each stock. To increase the probability that spawning biomass will be maintained above the Cutoff level, for those stocks which are marginally above Cutoff the following reduced catch level is recommended:

Catch = Forecast Run - Cutoff.

This will provide for smaller fisheries in areas where the 20% harvest rate would bring the escapement down to levels below the Cutoff.

Cutoff levels have been established through a stock-recruitment curve or bootstrapping of the observed recruitment time series. The Cutoff levels for the five major migratory stocks are:

	1992/93 Cutoff[a]	1994/95 Cutoff	1996/97 Cutoff	**Current Cutoff[c]**
Queen Charlotte Islands	11700	10700	10700	**10700**
Prince Rupert District[b]	12100	12100	12100	**12100**
Central Coast	10600	18800	17600	**17600**
Strait of Georgia	22100	21200	21200	**21200**
W.C. Vancouver Island	20300	18800	18800	**18800**

[a] - Cutoff level based on simulation model with stock-recruitment relationship, and two assessment areas on the WCVI.

[b] - Because of the poor performance of the age-structured model in this region in the past the Cutoff has not been recalculated using the bootstrap approach but is based on a stock-recruitment relationship.

[c] – A Cutoff of 14,000 tonnes was proposed for the Central Coast in 1998. Uncertainty about ASM performance in 1998 resulted in retention of the existing Cutoff.

It is important to note that the current Cutoff represents a commercial fishery fishing threshold rather than a conservation threshold or reference point. It is a reference point intended to maintain the reproductive capacity of the stock. Thus, even when a stock is near (or below) the stock-specific Cutoff, conservation concerns may be unwarranted as this information alone is insufficient to conclude that a stock may be at risk. The current commercial fishery Cutoff is used to maintain stock productivity or rebuild stock biomass following years when stock size decreases below the Cutoff.

Predicting recruitment for Pacific herring and most other fish species is difficult. In the absence of independent information, the scientific advice has been to assume an average recruitment to minimize forecasting errors. Currently, recruitment forecasting has been tested and validated for only the SG and WCVI stocks by PSARC. This forecast relies upon independent, offshore survey data collected during the summer prior to the recruitment of age-2+ fish to the spawning population. Recruitment forecasting methodologies are being developed for other herring stocks but none are currently in routine use. Therefore, a decision on the level of recruitment to be used in the forecast must be made in the absence of independent data. The decision about recruitment strength must be consistent with the precautionary approach to fisheries management while assuring harvest opportunities are not unduly restricted.

In the absence of alternative recruitment forecasting methods, the following rules have been adopted in developing the abundance forecast:

1. If the pre-fishery biomass was below Cutoff in the previous year, then assume POOR recruitment for the forecast. The modified harvest rule is likely to apply.

2. If the pre-fishery biomass was above Cutoff in the previous year and recruitment has been GOOD in the two previous years, then assume GOOD recruitment for the forecast.

3. If Rule 1 or Rule 2 DO NOT APPLY then assume AVERAGE recruitment for the forecast. The modified harvest rule may apply.

The harvest of minor stocks is also conducted in a precautionary manner given that no forecast of abundance in the upcoming season has been possible until now. The harvest rule for minor stocks is that a maximum of 10% of the estimated abundance in the current season may be harvested in the coming season. The harvest rule is based on the assumption that minor herring stock dynamics are consistent with the major migratory stocks which can sustain substantially higher rates of harvest. (Hall et al. 1988, Zheng et al. 1993).

SIZE AT AGE TRENDS

Inter-annual changes in growth rate of herring can have significant impacts on the size at age and consequently on estimates of stock productivity and availability to the harvesting sectors. Concern about declining size of herring in the late 1990s continues with no obvious indication of an increase in recent years (Fig. 27). Trends in size at age continue to be monitored and since 1999 have been incorporated into the management decision making process by providing an indication of the proportion of the stock estimated to be catchable by the gillnet sector.

ACKNOWLEDGEMENTS

Chuck Fort, Bruce McCarter, and Kristen Daniel updated the catch, biological sampling and spawn survey data bases and reviewed all 2006 assessment data. Howard Stiff provided programming support for the Access databases used to summarize the assessment data series. Database upgrades and ongoing maintenance have been funded by the Herring Conservation and Research Society (HCRS). The HCRS through the test fishing program also funded the collection of spawn survey information and test fishery biological samples coast-wide in support of the stock assessment analysis presented in this report.

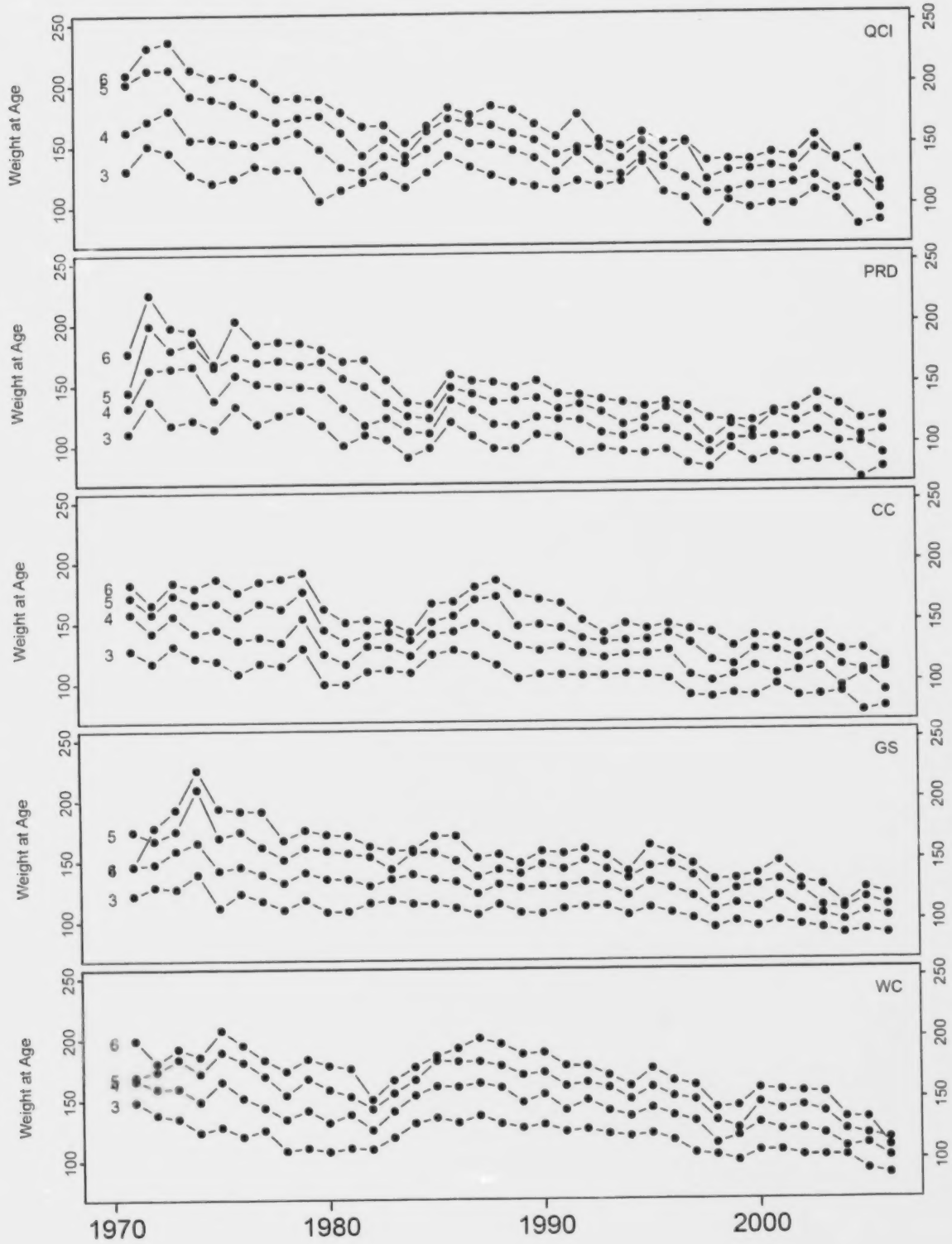


Figure 27. Estimates of weight-at-age (g) for 3-6 year old herring from 1951-2006 for the five major assessment regions.

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Appendix 1.1. Age composition and catch by season, fishery and gear type for the Queen Charlotte Islands stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19501	Seine	Jan-Apr	0.00	0.07	15.31	52.91	15.31	11.52	4.20	0.61	0.07	0.00	89.7	1,476	2,847	31.744
19512	Seine	Jan-Apr	1.92	24.77	20.96	29.67	17.98	3.71	0.93	0.07	0.00	0.00	78.4	2,251	10,147	122.347
19534	Seine	Jan-Apr	0.06	2.90	29.02	21.28	33.66	10.19	1.93	0.71	0.19	0.06	77.1	0 *	1,786	23.168
19545	Seine	Oct-Dec	0.00	8.74	14.08	39.42	18.06	14.85	4.37	0.29	0.10	0.10	94.1	0 *	99	1.047
	Seine	Jan-Apr	0.00	8.74	14.08	39.42	18.06	14.85	4.37	0.29	0.10	0.10	94.1	0 *	1,136	12.066
19556	Seine	Jan-Apr	0.00	0.15	16.02	9.64	62.17	8.38	2.74	0.74	0.00	0.15	118.2	1,348	77,681	657.044
19567	Seine	Jan-Apr	0.07	20.71	24.66	15.96	9.38	26.29	2.37	0.44	0.11	0.00	103.3	4,423	23,711	227.806
19578	Seine	Oct-Dec	0.00	81.58	16.66	1.26	0.16	0.14	0.14	0.00	0.00	0.00	52.1	2,769 +	721	13.844
	Seine	Jan-Apr	0.00	81.96	16.24	1.29	0.20	0.16	0.12	0.00	0.00	0.00	51.8	2,475	10,426	201.343
	Seine	May-Sep	0.00	81.58	16.66	1.26	0.16	0.14	0.14	0.00	0.00	0.00	52.1	2,769 +	19	0.357
19589	Seine	Oct-Dec	0.00	1.05	63.16	28.42	7.37	0.00	0.00	0.00	0.00	0.00	92.8	95 +	199	2.140
	Seine	Jan-Apr	0.00	1.05	63.16	28.42	7.37	0.00	0.00	0.00	0.00	0.00	92.8	95 +	6,828	73.560
19601	Seine	Jan-Apr	0.00	4.21	32.63	36.00	24.84	1.26	0.42	0.21	0.42	0.00	97.7	0 *	576	5.901
	Seine	May-Sep	0.00	4.21	32.63	36.00	24.84	1.26	0.42	0.21	0.42	0.00	97.7	0 *	77	0.789
19612	Seine	Jan-Apr	0.00	2.57	38.97	44.12	5.88	7.35	0.74	0.37	0.00	0.00	114.0	272 +	7,632	66.952
19623	Seine	Jan-Apr	0.00	0.37	50.00	27.11	18.16	2.11	1.99	0.00	0.12	0.12	109.5	804	14,705	134.232
	Seine	May-Sep	0.00	0.37	50.00	27.11	18.16	2.11	1.99	0.00	0.12	0.12	109.5	804 +	275	2.508
19634	Seine	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490	28,600	251.046
	Seine	May-Sep	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490 +	131	1.154
	Trawl	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490 +	46	0.401
19645	Seine	Jan-Apr	0.00	1.71	82.31	10.25	3.63	1.34	0.55	0.20	0.00	0.00	101.5	1,019	35,304	348.556
	Seine	May-Sep	0.00	1.67	81.75	10.30	4.02	1.47	0.59	0.20	0.00	0.00	102.0	1,019 +	145	1.419
19656	Seine	Jan-Apr	0.00	18.36	32.77	16.38	10.40	7.45	5.89	4.92	2.07	1.75	130.7	0 *	2,746	21.016
19667	Seine	Jan-Apr	0.00	0.88	67.25	26.49	2.65	2.72	0.00	0.00	0.00	0.00	113.0	0 *	213	1.883
19678	Seine	Jan-Apr	0.00	29.95	50.57	17.23	2.25	0.00	0.00	0.00	0.00	0.00	94.9	0 *	80	0.843
19701	Seine	Jan-Apr	0.00	6.50	50.40	29.30	8.00	4.30	0.80	0.50	0.20	0.00	118.1	0 *	102	0.861
19712	Seine	Jan-Apr	0.00	3.59	34.24	40.98	12.30	5.57	2.14	0.77	0.35	0.06	142.1	1,184	3,972	27.954
19723	Seine	Jan-Apr	0.00	0.20	32.91	18.91	32.99	11.77	2.10	1.13	0.00	0.00	140.7	1,726	7,520	49.735
19734	Seine	Jan-Apr	0.00	0.12	27.40	41.39	17.67	10.64	2.32	0.40	0.06	0.00	126.8	1,215	6,191	47.881
	Gillnet	Jan-Apr	0.00	0.00	5.73	48.41	25.48	16.56	3.18	0.00	0.00	0.64	153.8	157 +	127	0.824
19745	Seine	Jan-Apr	0.00	0.62	27.82	36.04	24.53	8.53	1.94	0.40	0.12	0.00	132.8	6,010	7,602	60.181
	Seine	May-Sep	0.00	0.13	33.28	45.41	13.55	5.29	1.72	0.46	0.17	0.00	116.3	3,026 +	17	0.147
	Gillnet	Jan-Apr	0.00	0.00	0.00	22.50	40.00	30.00	5.00	2.50	0.00	0.00	169.3	40 +	105	0.619
19756	Seine	Jan-Apr	0.00	0.30	2.98	44.51	31.53	15.24	4.61	0.76	0.06	0.00	155.4	4,055	11,939	82.499
	Seine	May-Sep	0.00	0.44	2.81	36.87	29.25	23.18	6.41	0.96	0.07	0.00	151.8	4,055 +	374	2.466
	Gillnet	Jan-Apr	0.00	0.00	0.00	0.75	21.80	60.90	14.29	2.26	0.00	0.00	196.2	133 +	1,802	9.186
19767	Seine	Jan-Apr	0.00	0.05	18.42	9.26	36.66	22.74	9.92	2.64	0.31	0.00	159.1	3,178	11,125	73.628
	Seine	May-Sep	0.00	0.09	19.67	8.12	29.70	22.91	14.66	4.44	0.41	0.00	157.1	3,178 +	21	0.132
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.53	16.61	39.71	27.08	11.55	2.17	0.36	196.6	277 +	1,489	7.575
19778	Seine	Jan-Apr	0.00	0.16	22.75	17.10	11.34	33.12	13.29	2.03	0.17	0.05	146.4	1,172	9,172	62.947
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.17	11.81	20.14	38.89	20.14	4.17	0.69	196.9	144 +	2,553	12.967
19789	Seine	Oct-Dec	0.00	6.22	4.91	32.53	18.23	20.31	14.19	3.06	0.44	0.11	149.9	916 +	50	0.336
	Seine	Jan-Apr	0.00	7.06	5.39	32.35	18.23	20.80	12.45	3.08	0.51	0.13	148.9	779	5,817	39.078
	Gillnet	Jan-Apr	0.00	0.00	0.00	28.24	25.88	27.06	15.29	3.53	0.00	0.00	160.1	170 +	2,086	13.028
19790	Seine	Jan-Apr	0.00	0.69	83.10	4.49	5.44	2.58	1.79	1.22	0.60	0.09	97.1	2,986	2,106	22.050
	Gillnet	Jan-Apr	0.00	0.00	6.50	4.56	44.47	19.36	19.58	4.20	1.34	0.00	157.6	518	1,210	7.739
19801	Seine	Jan-Apr	0.00	0.42	3.05	85.37	5.13	3.08	1.92	0.68	0.21	0.14	116.3	5,551	3,888	32.912
	Seine	May-Sep	0.00	1.33	3.92	88.65	2.94	1.73	0.69	0.35	0.23	0.17	112.7	1,735 +	39	0.342
	Gillnet	Jan-Apr	0.00	0.00	0.30	72.00	8.55	9.84	5.88	2.84	0.60	0.00	141.9	790	1,705	11.930
19812	Seine	Jan-Apr	0.00	0.45	3.26	3.50	87.61	2.19	1.34	0.95	0.57	0.12	127.2	3,526	2,353	18.420
	Seine	May-Sep	0.00	0.85	4.68	4.48	84.32	2.47	1.53	0.99	0.54	0.14	128.0	3,526 +	18	0.138
	Gillnet	Jan-Apr	0.00	0.00	0.21	3.35	89.10	3.35	2.31	1.05	0.42	0.21	141.9	477	1,407	9.918
19823	Seine	Jan-Apr	0.00	4.14	4.21	3.02	5.75	77.05	3.65	1.33	0.70	0.14	148.7	1,425	4,601	30.942
	Seine	May-Sep	0.00	4.88	5.23	3.51	6.86	72.87	3.91	1.58	0.91	0.25	146.9	1,968 +	67	0.457
	Gillnet	Jan-Apr	0.00	0.00	0.00	1.19	2.38	90.32	2.72	2.38	0.51	0.51	158.5	589	929	5.860
19834	Seine	Jan-Apr	0.00	2.09	36.57	4.17	2.64	9.56	43.33	1.11	0.35	0.17	126.1	3,484	4,054	31.997
	Seine	May-Sep	0.00	2.70	36.39	4.54	2.87	10.10	41.76	1.12	0.34	0.17	125.5	3,484 +	58	0.459
	Gillnet	Jan-Apr	0.00	0.00	2.81	1.28	4.60	8.95	80.05	1.79	0.26	0.26	154.6	391 +	535	3.459
19845	Seine	Jan-Apr	0.00	0.12	8.63	25.14	3.52	3.93	12.79	45.24	0.53	0.10	146.4	3,099	4,581	27.888
	Seine	May-Sep	0.00	0.10	8.15	24.49	3.51	3.95	12.94	46.22	0.54	0.10	165.5	2,025 +	35	0.209
	Gillnet	Jan-Apr	0.00	0.00	8.30	24.48	2.90	4.56	12.45	46.89	0.41	0.00	155.0	241 +	1,493	9.632
19856	Seine	Jan-Apr	0.00	0.16	2.00	21.05	37.46	3.69	3.28	8.88	23.03	0.43	165.5	4,462	2,613	15.278
	Trawl	Jan-Apr	0.00	0.31	2.80	10.56	37.58	8.70	9.63	11.18	17.70	1.55	163.5	322	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.00	12.73	53.42	4.04	5.28	9.01	15.22	0.31	159.7	322 +	890	5.576
19867	Seine	Jan-Apr	0.00	1.78	9.60	4.90	24.93	38.44	3.88	4.36	5.86	6.24	158.6	2,916	2,028	12.787
	Seine	May-Sep	0.00	1.74	10.42	5.85	24.35	37.76	3.84	4.33	5.79	5.91	157.2	3,281 +	33	0.210
19878	Seine	Jan-Apr	0.00	3.64	51.01	7.52	4.77	11.75	14.86	1.37	1.67	3.40	123.6	1,676	0	0.000 -
	Seine	May-Sep	0.00	1.34	41.98	5.34	3.24	14.50	22.71	1.91	1.72	7.25	136.5	524 +	32	0.232
	Trawl	Jan-Apr	0.00	1.33	68.11	11.63	1.66	6.98	6.64	1.33	1.66	0.66	105.4	301	0	0.000 -
19889	Seine	Jan-Apr	0.00	3.43	5.12	85.99	3.74	0.18	0.77	0.47	0.08	0.22	119.2	2,996	1,449	11.972
	Seine	May-Sep	0.00	1.27	31.75	45.90	4.03	2.55	7.00	4.81	1.06	1.63	117.4	1,414 +	13	0.108
19890	Seine	Jan-Apr	0.00	0.14	10.61	6.53	78.55	2.43	0.33	0.85	0.34	0.23	133.9	4,769	5,542	39.649
	Gillnet	Jan-Apr	0.00	0.00	0.51	8.18	44.50	9.97	8.44	17.39	8.44	2.56	149.6	391 +	1,170	7.821
19901	Seine	Jan-Apr	0.00	5.60	4.25	10.74	33.21	33.99	3.68	2.00	4.70	1.84	127.8	2,448	3,899	30.506
	Trawl	Jan-Apr	0.00	1.06	4.26	8.51	21.28	46.81	4.26	6.38	4.26	3.19	143.0	94	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.27	22.44	43.47	9.66	7.10	10.23	4.83	151.9	352 +	543	3.576
19912	Seine	Jan-Apr	0.00	1.05	30.50	4.25	8.27	4.46	48.40	2.42	0.14	0.52	143.2	3,228	2,524	16.695
	Trawl	Jan-Apr	0.00	1.08	54.84	9.68	2.15	15.05	11.83	3.23	2.15	0.00	115.6	93	0	0.000 -

Appendix 1.1. Age composition and catch by season, fishery and gear type for the Queen Charlotte Islands stock assessment region. These data are used for the age-structured model analysis.

Season	Gear	Fishery	PERCENT AT AGE										Mean Weight	Number Aged	CATCH (tonnes)	CATCH (millions)
			0+	1+	2+	3+	4+	5+	6+	7+	8+	9++				
19923	Seine	Jan-Apr	0.00	0.04	2.79	67.33	4.25	4.68	9.73	9.95	0.87	0.36	124.2	2,755	2,699	21.742
	Trawl	Jan-Apr	0.00	1.75	4.68	59.65	5.85	6.43	11.70	7.02	2.34	0.58	125.9	171	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.27	22.44	43.47	9.66	7.10	10.23	4.83	151.9	352 +	0	0.002
19934	Seine	Jan-Apr	0.00	5.50	5.50	5.63	40.75	12.87	14.48	11.13	3.49	0.67	130.5	746	299	2.291
	Trawl	Jan-Apr	0.00	7.08	2.36	5.42	53.30	8.49	6.60	8.49	7.31	0.94	133.0	424	0	0.000 ~
19945	Seine	Jan-Apr	0.00	14.35	15.82	2.32	4.43	37.55	9.70	8.02	5.27	2.53	134.8	474	0	0.000 ~
19956	Seine	Jan-Apr	0.10	10.76	53.81	9.30	3.24	3.34	15.57	2.40	1.15	0.31	102.8	957	0	0.000 ~
19967	Seine	Jan-Apr	0.00	22.64	26.17	33.41	5.23	1.52	4.44	5.36	0.85	0.37	97.5	1,643	0	0.000 ~
19978	Seine	Jan-Apr	0.00	0.16	58.12	27.55	9.74	2.53	0.48	0.40	0.63	0.40	87.9	1,263	1,372	15.597
19989	Seine	Jan-Apr	0.00	3.71	2.16	65.00	16.83	8.03	2.78	0.67	0.41	0.41	105.9	1,943	2,500	23.604
	Gillnet	Jan-Apr	0.00	0.00	0.67	30.78	22.80	29.12	9.98	2.66	1.33	2.66	131.4	601	473	3.596
19990	Seine	Jan-Apr	0.00	3.63	17.30	3.71	60.69	8.26	5.25	0.39	0.62	0.15	106.9	1,295	1,764	16.500
20001	Seine	Jan-Apr	0.00	15.26	31.65	22.32	5.06	20.92	3.05	1.39	0.26	0.09	97.0	1,147	0	0.000 ~
20012	Seine	Jan-Apr	0.00	20.84	22.90	25.47	12.99	3.11	12.83	1.36	0.43	0.08	93.6	2,572	706	7.543
20023	Seine	Jan-Apr	0.00	0.08	68.16	18.33	6.43	3.24	1.13	2.10	0.40	0.12	96.7	2,472	0	0.000 ~
20034	Seine	Jan-Apr	0.00	29.35	2.37	50.65	8.76	4.02	2.60	1.42	0.59	0.24	91.5	845	0	0.000 ~
20045	Seine	Jan-Apr	0.00	1.30	46.29	15.66	28.57	3.90	2.37	1.22	0.46	0.23	93.9	1,309	0	0.000 ~
20056	Seine	Jan-Apr	0.00	19.07	10.10	42.78	9.40	15.15	2.81	0.42	0.00	0.28	83.3	713	0	0.000 ~

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19501	Seine	Oct-Dec	0.03	5.19	18.96	57.83	10.05	5.42	2.27	0.20	0.06	0.00	91.5	3,524	27,192	297.109
	Seine	Jan-Apr	0.09	1.72	15.86	60.43	11.38	6.21	3.79	0.43	0.00	0.09	95.8	1,160	18,674	195.022
19512	Seine	Oct-Dec	0.09	5.32	9.32	33.19	45.08	5.66	0.91	0.40	0.03	0.00	121.7	3,498	42,613	350.112
	Seine	Jan-Apr	0.00	3.96	8.08	34.32	45.41	6.84	1.19	0.16	0.04	0.00	115.7	2,427	9,650	83.415
	Seine	May-Sep	0.05	4.76	8.81	33.65	45.22	6.14	1.03	0.30	0.03	0.00	119.2	5,925 +	116	0.976
19523	Seine	Oct-Dec	0.00	1.46	38.05	28.90	26.40	4.99	0.21	0.00	0.00	0.00	114.7	481	401	3.491
	Seine	Jan-Apr	0.00	1.07	38.17	20.04	24.95	14.29	1.39	0.11	0.00	0.00	107.7	938	1,465	13.601
19534	Seine	Oct-Dec	0.00	0.38	22.98	31.95	27.13	14.48	2.52	0.56	0.01	0.00	114.3	2,138	26,692	232.215
	Seine	Jan-Apr	0.00	8.88	47.88	19.11	13.51	6.76	3.28	0.58	0.00	0.00	83.9	518	584	6.969
19545	Seine	Jan-Apr	0.00	2.25	4.08	70.30	15.80	6.01	1.34	0.22	0.00	0.00	105.2	1,131	17,806	167.544
19556	Seine	Oct-Dec	0.00	10.04	58.11	9.51	18.95	2.55	0.53	0.18	0.12	0.00	83.6	1,683 +	1,602	19.164
	Seine	Jan-Apr	0.00	8.99	59.62	9.14	18.79	2.65	0.66	0.07	0.07	0.00	84.6	1,357	8,580	101.455
19567	Seine	Oct-Dec	0.00	18.02	19.80	35.57	12.24	13.25	0.90	0.22	0.00	0.00	93.8	3,172 +	820	9.056
	Seine	Jan-Apr	0.00	3.83	19.26	42.33	13.46	19.05	1.61	0.41	0.05	0.00	104.8	2,784	19,753	182.450
	Seine	May-Sep	0.00	0.00	7.11	44.95	37.16	9.17	1.38	0.23	0.00	0.00	106.7	436	7,461	69.921
	Trawl	Jan-Apr	0.00	4.08	21.43	52.04	12.24	10.20	0.00	0.00	0.00	0.00	88.3	98	0	0.000
19578	Seine	Oct-Dec	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497 +	1,270	20.260
	Seine	Jan-Apr	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497 +	667	10.640
	Seine	May-Sep	0.00	58.55	24.14	6.24	7.24	0.80	3.02	0.00	0.00	0.00	62.7	497 +	2,586	41.259
19589	Seine	Oct-Dec	0.00	1.64	62.11	19.52	5.96	7.16	2.05	1.54	0.01	0.00	98.0	1,592 +	1,629	16.406
	Seine	Jan-Apr	0.00	2.88	61.03	19.34	5.06	7.96	1.81	1.85	0.06	0.00	97.5	1,454	5,629	57.722
	Seine	May-Sep	0.00	1.17	62.96	19.29	6.19	6.74	2.21	1.44	0.56	0.00	98.7	1,592 +	2,899	29.047
	Trawl	Jan-Apr	0.00	3.39	58.98	20.35	5.15	8.73	1.44	1.88	0.06	0.00	97.5	1,592 +	66	0.674
19590	Seine	Oct-Dec	0.00	62.74	8.21	20.55	5.57	1.63	1.10	0.08	0.12	0.00	64.7	1,549	3,125	49.715
	Seine	Jan-Apr	0.00	66.74	7.43	18.52	4.46	1.48	0.94	0.22	0.22	0.00	61.5	1,617	12,513	218.740
	Seine	May-Sep	0.00	5.00	3.26	51.30	20.22	10.65	7.39	1.96	0.22	0.00	115.5	460	2,297	19.897
	Trawl	Oct-Dec	0.00	59.38	7.49	23.25	6.10	2.21	1.17	0.22	0.19	0.00	64.7	3,166 +	72	1.110
	Trawl	Jan-Apr	0.00	59.38	7.49	23.25	6.10	2.21	1.17	0.22	0.19	0.00	64.7	3,166 +	468	7.238
19601	Seine	Oct-Dec	0.00	13.33	69.22	4.76	9.50	2.44	0.44	0.25	0.06	0.00	80.6	1,729	14,879	183.842
	Seine	Jan-Apr	0.00	8.10	60.17	6.91	18.06	4.38	1.74	0.43	0.20	0.00	93.8	2,174	24,244	278.906
	Seine	May-Sep	0.00	10.08	59.51	7.23	17.13	4.07	1.43	0.42	0.13	0.00	93.9	3,903 +	350	4.012
	Trawl	Jan-Apr	0.00	10.25	60.16	7.07	16.63	3.97	1.38	0.41	0.13	0.00	86.7	3,903 +	3,273	37.756
19612	Seine	Oct-Dec	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403 +	633	5.938
	Seine	Jan-Apr	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403 +	25,352	237.877
	Seine	May-Sep	0.00	6.70	32.01	38.46	7.44	11.41	2.23	0.74	0.74	0.25	106.6	403 +	346	3.243
	Trawl	Oct-Dec	0.00	6.05	30.85	38.31	7.66	11.69	3.43	0.60	1.01	0.40	109.0	496 +	296	2.714
	Trawl	Jan-Apr	0.00	6.05	30.85	38.31	7.66	11.69	3.43	0.60	1.01	0.40	109.0	496 +	1,033	9.474
19623	Seine	Oct-Dec	0.00	76.33	15.42	4.46	3.10	0.28	0.35	0.06	0.00	0.00	55.5	1,267	9,769	199.178
	Seine	Jan-Apr	0.00	38.55	15.20	21.58	17.43	3.27	3.61	0.21	0.06	0.10	96.9	1,921	29,142	350.900
	Seine	May-Sep	0.00	60.74	16.33	12.62	7.12	1.42	1.69	0.01	0.00	0.07	74.6	3,188 +	736	11.819
	Trawl	Oct-Dec	0.00	41.59	13.61	17.25	21.11	3.14	2.79	0.41	0.06	0.03	80.9	3,188 +	123	1.526
	Trawl	Jan-Apr	0.00	41.59	13.61	17.25	21.11	3.14	2.79	0.41	0.06	0.03	80.9	3,188 +	457	5.653
19634	Seine	Oct-Dec	0.00	2.51	71.43	11.94	7.88	5.04	0.85	0.35	0.00	0.00	84.2	1,644	14,887	170.573
	Seine	Jan-Apr	0.00	1.29	48.47	10.21	19.65	17.00	1.48	1.38	0.40	0.11	89.9	1,697	13,180	135.777
	Seine	May-Sep	0.00	2.89	67.52	11.86	10.20	6.38	0.60	0.43	0.11	0.02	80.8	3,341 +	1,282	14.960
	Trawl	Oct-Dec	0.00	3.26	65.07	10.15	11.10	8.98	0.69	0.60	0.12	0.03	85.8	3,341 +	44	0.519
	Trawl	Jan-Apr	0.00	3.26	65.07	10.15	11.10	8.98	0.69	0.60	0.12	0.03	85.8	3,341 +	537	6.254
19645	Seine	Oct-Dec	0.00	9.22	19.05	45.55	10.13	10.34	4.75	0.71	0.22	0.03	127.7	805	5,435	40.840
	Seine	Jan-Apr	0.00	4.99	13.41	53.55	9.70	9.66	7.23	1.03	0.37	0.06	118.0	2,088	12,851	99.593
	Seine	May-Sep	0.00	6.54	15.87	50.81	10.48	9.83	5.18	0.95	0.34	0.77	124.0	2,893 +	25,924	191.386
19656	Seine	Oct-Dec	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	3,312	24.120
	Seine	Jan-Apr	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	9,151	66.643
	Seine	May-Sep	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	4,831	35.181
	Trawl	Jan-Apr	0.00	0.00	5.29	21.38	23.45	16.32	19.08	9.66	3.22	1.61	137.3	0 *	1	0.007
19667	Seine	Oct-Dec	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0 *	4,379	66.650
	Seine	Jan-Apr	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0 *	2,338	35.588
	Seine	May-Sep	0.00	57.22	32.31	5.37	1.88	2.70	0.41	0.20	0.00	0.00	65.7	0 *	1,280	19.484
19678	Seine	Oct-Dec	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0 *	53	0.678
	Seine	Jan-Apr	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0 *	1,084	13.902
	Seine	May-Sep	0.00	34.87	39.74	19.40	4.59	0.73	0.26	0.14	0.27	0.00	77.9	0 *	932	11.953
19690	Seine	Jan-Apr	0.00	18.67	62.91	15.11	3.12	0.03	0.08	0.08	0.00	0.00	81.6	0 *	1,330	16.304
19701	Seine	Jan-Apr	0.00	5.79	45.91	31.35	9.51	5.05	1.63	0.59	0.15	0.00	92.2	673	3,418	37.076
	Seine	May-Sep	0.00	5.79	45.91	31.35	9.51	5.05	1.63	0.59	0.15	0.00	92.2	673 +	82	0.894
19712	Seine	Jan-Apr	0.00	0.00	5.32	17.93	64.43	5.88	3.78	2.38	0.14	0.14	161.3	714	4,490	27.842
	Gillnet	Jan-Apr	0.00	0.00	0.96	39.42	21.15	34.62	2.88	0.96	0.00	0.00	168.2	104 +	4	0.023
19723	Seine	Oct-Dec	0.00	3.89	35.37	4.95	27.58	23.05	3.26	1.26	0.63	0.00	133.3	950 +	16	0.123
	Seine	Jan-Apr	0.00	0.61	33.23	4.45	30.09	26.25	3.38	1.26	0.74	0.00	137.9	950	1,524	10.454
	Seine	May-Sep	0.00	3.89	35.37	4.95	27.58	23.05	3.26	1.26	0.63	0.00	133.3	950 +	67	0.499
19734	Seine	Jan-Apr	0.00	0.16	17.88	53.16	7.44	16.46	4.43	0.32	0.16	0.00	132.2	632	2,300	17.401
	Gillnet	Jan-Apr	0.00	0.00	0.96	39.42	21.15	34.62	2.88	0.96	0.00	0.00	168.2	104 +	1,519	9.034
19745	Seine	Jan-Apr	0.20	0.35	4.42	26.83	51.39	9.06	6.31	1.26	0.18	0.00	124.1	1,704	1,691	12.357
	Gillnet	Jan-Apr	0.00	0.00	0.00	31.91	59.57	8.51	0.00	0.00	0.00	0.00	140.9	47 +	11	0.076
19756	Seine	Oct-Dec	0.00	0.00	1.60	6.86	27.66	43.89	9.26	8.46	2.29	0.00	172.2	875 +	564	3.278
	Seine	Jan-Apr	0.00	0.00	0.90	7.22	32.25	49.73	7.47	1.74	0.70	0.00	169.6	713	3,466	20.451
	Gillnet	Jan-Apr	0.00	0.00	0.00	15.79	57.89	22.81	3.51	0.00	0.00	0.00	154.0	57 +	276	1.793
19767	Seine	Oct-Dec	0.00	0.08	13.52	6.40	24.30	35.92	14.53	4.01	0.80	0.43	154.2	1,821 +	296	1.895
	Seine	Jan-Apr	0.00	0.13	21.43	3.97	20.78	34.28	14.49	3.18	1.29	0.45	151.9	1,765	6,309	41.462
	Seine	May-Sep	0.00	0.16	18.12	7.08	22.73	31.85	13.84	4.45	1.32	0.44	149.8	1,821 +	31	0.204
	Gillnet	Jan-Apr	0.00	0.00	1.07	2.14	19.93	54.09	14.59	6.76	1.42	0.00	166.9	281 +	1,494	8.948

Appendix 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
	Gillnet	May-Sep	0.00	0.00	1.07	2.14	19.93	54.09	14.59	6.76	1.42	0.00	166.9	281 +	12	0.072
19778	Seine	Oct-Dec	0.00	1.66	7.66	32.30	17.60	16.98	13.46	6.21	2.48	1.66	151.1	483	2,263	14.977
	Seine	Jan-Apr	0.00	1.35	12.58	34.86	9.09	19.63	18.84	2.66	0.67	0.32	147.2	812	2,202	14.957
	Seine	May-Sep	0.00	1.73	12.50	38.39	9.35	18.12	15.88	2.73	0.92	0.38	147.1	1,295 +	68	0.469
	Trawl	Oct-Dec	0.00	1.36	10.03	31.95	13.18	19.41	17.48	4.37	1.43	0.79	150.3	1,396 +	1,024	6.814
	Trawl	Jan-Apr	0.00	0.99	2.97	20.79	19.80	25.74	20.79	7.92	0.99	0.00	167.6	101	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.00	20.53	5.96	32.45	33.11	6.62	1.32	0.00	167.1	151 +	3,031	18.142
19789	Seine	Oct-Dec	0.00	1.42	9.81	10.85	25.36	19.39	17.10	8.63	4.73	2.71	152.3	777	971	6.314
	Seine	Jan-Apr	0.00	2.91	9.88	12.21	32.17	13.57	21.32	5.81	1.74	0.39	158.5	516	1,411	8.905
	Seine	May-Sep	0.00	2.19	14.84	11.37	28.12	14.72	17.26	6.93	2.94	1.62	151.3	1,732 +	10	0.063
	Trawl	Oct-Dec	0.00	2.04	9.07	10.37	27.96	15.37	15.37	8.52	7.04	4.26	147.9	540	690	4.664
	Trawl	Jan-Apr	0.00	2.04	9.07	10.37	27.96	15.37	15.37	8.52	7.04	4.26	147.9	540	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.00	8.25	41.24	18.56	22.68	7.56	1.72	0.00	168.4	291 +	1,236	7.338
19790	Seine	Oct-Dec	0.00	1.82	62.62	6.88	6.93	7.57	5.81	5.21	2.12	1.04	108.2	1,049	460	4.238
	Seine	Jan-Apr	0.00	1.69	85.42	4.98	2.89	2.29	1.69	0.70	0.30	0.05	90.0	2,010	1,641	18.223
	Trawl	Oct-Dec	0.00	1.59	73.25	7.18	5.79	4.99	3.78	2.12	0.91	0.39	99.0	4,389 +	278	2.806
	Trawl	Jan-Apr	0.00	0.00	47.95	12.33	10.96	16.44	1.37	5.48	4.11	1.37	123.9	73	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	4.98	7.66	35.25	19.92	19.54	8.43	3.45	0.77	162.2	261 +	1,046	6.449
19801	Seine	Oct-Dec	0.00	1.13	7.37	53.52	10.15	10.64	8.82	4.51	2.45	1.40	124.7	3,068	733	5.870
	Seine	Jan-Apr	0.03	0.57	10.08	82.32	3.36	1.46	1.55	0.32	0.19	0.13	98.7	3,156	1,051	10.652
	Trawl	Oct-Dec	0.00	1.07	7.67	56.82	8.62	9.09	9.02	3.68	2.37	1.66	119.0	3,095	949	7.928
	Trawl	Jan-Apr	0.00	1.07	7.21	55.35	8.89	9.56	9.66	4.17	2.36	1.74	121.0	3,095	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.37	39.18	16.42	23.13	14.55	4.48	1.87	0.00	149.7	268 +	356	2.378
19812	Seine	Oct-Dec	0.00	0.83	14.25	24.70	45.73	6.01	3.80	3.07	1.13	0.49	128.5	1,143	794	6.481
	Seine	Jan-Apr	0.00	4.57	11.84	7.15	71.51	2.93	1.41	0.35	0.23	0.00	106.5	853	170	1.593
	Trawl	Oct-Dec	0.00	2.34	11.99	19.03	39.60	10.11	6.80	6.60	2.13	1.39	132.6	1,283	1,021	7.686
	Trawl	Jan-Apr	0.00	2.34	11.85	18.08	40.14	10.37	6.94	6.24	2.42	1.64	132.6	1,283	0	0.000 -
19823	Seine	Jan-Apr	0.00	1.35	20.82	17.74	5.26	49.16	3.73	1.13	0.59	0.22	117.7	4,583	0	0.000 -
19834	Seine	Oct-Dec	0.00	1.83	34.08	15.42	15.21	10.14	19.68	3.04	0.20	0.41	97.1	493	87	0.900
	Seine	Jan-Apr	0.00	0.43	32.79	11.18	9.48	17.31	27.38	0.95	0.33	0.14	106.6	3,118	1,679	15.337
	Seine	May-Sep	0.00	0.72	36.17	14.18	10.77	13.79	22.65	1.27	0.28	0.17	102.7	3,611 +	6	0.055
	Trawl	Oct-Dec	0.00	0.93	36.45	14.29	10.74	13.57	21.95	1.30	0.42	0.34	102.3	3,772 +	54	0.529
	Trawl	Jan-Apr	0.00	5.59	42.86	16.77	9.94	8.70	6.21	1.86	3.73	4.35	93.4	161	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.99	1.98	12.87	21.39	57.43	3.37	1.19	0.79	147.7	505	1,880	12.731
19845	Seine	Oct-Dec	0.00	17.10	8.92	20.45	30.67	12.83	4.46	4.28	0.93	0.37	86.0	538	48	0.556
	Seine	Jan-Apr	0.00	0.33	7.91	50.78	11.15	6.74	12.95	9.81	0.19	0.16	108.4	4,214	3,070	27.724
	Seine	May-Sep	0.00	2.15	7.95	50.48	14.31	7.07	10.01	7.61	0.27	0.17	108.3	4,752 +	70	0.662
	Trawl	Oct-Dec	0.00	2.31	7.95	50.46	14.56	7.09	9.74	7.41	0.27	0.17	105.8	4,752 +	83	0.787
	Gillnet	Jan-Apr	0.00	0.00	0.36	16.36	14.91	15.82	21.82	29.82	0.36	0.55	147.9	550	3,476	23.500
19856	Seine	Oct-Dec	0.00	1.77	12.72	10.13	44.29	9.00	5.23	8.78	7.96	0.11	139.2	3,554 +	130	0.937
	Seine	Jan-Apr	0.00	1.75	12.79	10.09	44.41	9.10	5.23	8.69	7.83	0.11	133.1	5,655	3,823	27.523
	Seine	May-Sep	0.00	1.69	13.34	9.55	46.09	10.53	5.26	7.46	5.98	0.10	137.1	5,655 +	105	0.778
	Trawl	Oct-Dec	0.00	12.11	11.13	9.48	27.58	16.27	9.30	5.81	5.02	3.30	137.9	1,635	47	0.343
	Trawl	Jan-Apr	0.00	12.11	11.13	9.48	27.58	16.27	9.30	5.81	5.02	3.30	137.9	1,635	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.38	4.09	54.02	18.86	8.71	7.65	6.06	0.23	147.0	1,320	4,573	31.100
19867	Seine	Oct-Dec	0.00	0.60	38.78	9.59	7.26	29.94	5.84	3.59	3.09	1.33	117.1	2,977 +	47	0.398
	Seine	Jan-Apr	0.00	0.45	39.37	9.51	7.32	29.04	5.78	3.72	3.34	1.47	117.1	4,049	2,100	17.695
	Seine	May-Sep	0.00	1.06	36.99	9.81	7.06	32.66	6.01	3.21	2.31	0.89	117.1	2,977 +	52	0.448
	Gillnet	Jan-Apr	0.00	0.00	0.50	2.67	6.37	55.23	16.65	9.37	6.07	3.14	150.4	1,855	4,071	27.067
19878	Seine	Oct-Dec	0.00	0.52	35.53	36.87	5.23	7.15	11.18	1.59	1.43	0.49	100.3	3,076 +	23	0.229
	Seine	Jan-Apr	0.00	0.52	35.53	36.87	5.23	7.15	11.18	1.59	1.43	0.49	100.3	3,076	3,550	35.399
	Seine	May-Sep	0.00	0.45	30.98	38.94	5.97	8.35	11.53	1.95	1.45	0.38	102.6	4,206 +	56	0.542
	Trawl	Jan-Apr	0.00	0.26	13.73	41.19	11.92	11.14	11.92	4.40	4.15	1.30	109.5	386	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.24	4.97	4.59	20.02	48.56	13.52	5.31	2.78	157.2	710	4,340	27.459
19889	Seine	Oct-Dec	0.00	0.21	25.24	29.11	30.29	4.94	4.83	4.40	0.64	0.32	105.0	931 +	42	0.403
	Seine	Jan-Apr	0.00	0.70	19.15	41.92	25.84	4.00	4.19	3.39	0.46	0.36	104.1	2,893	3,686	35.672
	Gillnet	Jan-Apr	0.00	0.00	0.00	5.11	30.02	13.98	22.91	21.87	3.66	2.46	149.3	476	4,745	31.739
19890	Seine	Jan-Apr	0.00	0.63	20.05	21.02	29.59	18.95	3.90	3.41	2.08	0.37	120.7	4,215	2,295	19.231
	Seine	May-Sep	0.00	0.14	14.00	25.59	26.19	24.51	3.85	3.58	1.99	0.14	120.9	5,068 +	32	0.263
	Gillnet	Jan-Apr	0.00	0.00	0.00	6.25	21.32	42.46	10.29	11.58	6.07	2.02	146.7	544	2,361	16.100
19901	Seine	Jan-Apr	0.00	1.07	51.92	9.89	11.11	15.82	7.04	1.23	0.91	1.03	98.8	2,529	1,348	13.642
	Seine	May-Sep	0.00	0.55	40.80	10.75	16.94	17.49	11.29	1.82	0.00	0.36	108.1	549 +	19	0.172
	Trawl	Jan-Apr	0.00	17.05	28.41	5.68	22.73	6.82	6.82	0.00	2.27	10.23	110.2	88	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.26	18.67	31.44	31.33	6.66	4.37	3.28	144.5	916	2,143	14.832
19912	Seine	Jan-Apr	0.00	0.19	45.84	29.44	6.36	5.42	7.73	3.60	0.74	0.67	96.6	4,265	1,377	14.161
	Seine	May-Sep	0.00	0.70	24.97	53.31	5.57	5.34	5.23	3.95	0.46	0.46	96.2	861 +	3	0.027
	Trawl	Jan-Apr	0.00	14.10	21.79	20.94	8.97	18.80	6.41	4.70	1.28	2.99	108.5	234	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.32	13.21	9.13	23.52	25.35	19.66	3.97	4.83	145.5	931	3,797	26.100
19923	Seine	Jan-Apr	0.00	0.04	6.28	56.22	21.93	4.18	4.46	4.86	1.59	0.44	103.4	3,262	2,204	20.895
	Seine	May-Sep	0.00	0.40	21.17	25.83	39.41	4.26	3.73	3.20	1.73	0.27	101.3	751 +	5	0.046
	Trawl	Jan-Apr	0.00	6.59	31.87	31.32	22.53	2.75	3.85	1.10	0.00	0.00	91.4	182	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.00	8.32	40.54	9.53	18.52	13.29	8.19	1.51	134.1	745	4,112	30.661
19934	Seine	Jan-Apr	0.00	0.47	3.34	10.44	54.82	20.19	4.55	4.05	1.50	0.64	108.9	6,643	2,364	21.475
	Trawl	Jan-Apr	0.00	3.61	4.64	27.84	38.66	20.10	2.58	1.55	1.03	0.00	106.1	194	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.00	3.15	18.85	48.99	11.78	11.14	4.86	1.24	132.6	899	2,324	17.614
19945	Seine	Jan-Apr	0.08	3.82	12.91	5.38	9.57	49.66	13.84	2.46	1.44	0.82	113.1	3,532	706	6.242
	Gillnet	Jan-Apr	0.00	0.00	0.12	1.18	16.98	34.79	39.39	4.13	1.89	1.53	131.4	848	1,355	10.311
19956	Seine	Jan-Apr	0.00	1.08	65.37	8.94	2.82	4.26	11.72	5.19	0.37	0.26	89.0	2,697	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.78	4.11	5.68	25.83	32.68	26.42	3.13	1.37	133.8	511	3,086	23.053

Appendix 1.2. Age composition and catch by season, fishery and gear type for the Prince Rupert District stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19967	Seine	Jan-Apr	0.00	1.30	22.79	53.63	8.01	2.52	4.93	4.74	1.85	0.22	88.5	2,698	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.16	19.49	11.57	13.95	20.29	20.60	11.09	2.85	133.4	531	5,541	41.550
19978	Seine	Jan-Apr	0.00	0.19	33.18	21.98	36.29	4.44	1.42	1.09	1.28	0.14	83.2	2,116	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.65	3.05	43.07	20.52	9.89	11.28	7.02	4.53	127.9	1,082	3,217	25.158
19989	Seine	Jan-Apr	0.00	0.93	3.39	51.17	20.68	17.76	2.92	0.47	1.17	1.52	105.5	856	256	2.426
	Gillnet	Jan-Apr	0.00	0.00	0.00	11.18	16.22	48.98	13.23	4.72	2.20	3.46	126.1	721	1,858	14.716
19990	Seine	Jan-Apr	0.00	1.71	24.71	8.27	36.25	14.34	11.83	1.99	0.41	0.49	95.9	3,685	1,314	12.980
	Gillnet	Jan-Apr	0.00	0.00	0.12	2.10	23.06	20.47	42.17	9.37	1.11	1.60	133.7	811	3,001	22.441
20001	Seine	Jan-Apr	0.00	0.53	28.84	25.30	5.65	23.85	9.15	5.34	1.14	0.22	103.9	2,285	1,012	9.743
	Gillnet	Jan-Apr	0.00	0.00	0.29	5.58	9.33	32.40	20.67	25.58	5.29	0.87	134.3	1,040	1,905	14.183
20012	Seine	Oct-Dec	0.00	5.18	19.99	36.74	18.99	3.93	9.56	3.51	1.79	0.30	90.3	5,577 +	1	0.009
	Seine	Jan-Apr	0.00	7.21	19.39	32.03	20.34	4.16	11.12	3.83	1.60	0.33	93.0	3,678	2,061	22.159
	Gillnet	Jan-Apr	0.00	0.00	0.11	7.05	20.25	11.72	27.42	15.81	15.36	2.28	143.2	879	2,432	16.982
20023	Seine	Oct-Dec	0.00	0.79	67.83	13.49	11.10	3.13	1.52	1.15	0.48	0.51	85.1	659 +	5	0.068
	Seine	Jan-Apr	0.00	0.07	53.06	13.44	14.53	9.54	2.97	4.24	1.47	0.68	95.3	2,925	1,446	15.169
	Gillnet	Jan-Apr	0.00	0.00	0.34	4.60	37.13	25.98	10.57	12.30	5.29	3.79	136.6	870	2,562	18.760
20034	Seine	Oct-Dec	0.00	0.91	1.98	69.32	11.20	10.06	4.20	0.91	1.27	0.16	83.7	2,526 +	11	0.116
	Seine	Jan-Apr	0.00	0.88	1.76	69.88	10.58	9.88	4.45	0.97	1.39	0.19	96.0	2,155	1,908	19.885
	Gillnet	Jan-Apr	0.00	0.00	0.09	21.84	13.52	36.88	15.40	4.92	4.74	2.60	134.5	1,117	2,192	16.304
20045	Seine	Jan-Apr	0.00	0.75	26.59	8.92	45.51	9.21	6.06	2.02	0.52	0.42	82.8	2,129	1,750	18.855
	Gillnet	Jan-Apr	0.00	0.00	0.00	0.80	46.42	18.04	25.86	5.84	1.33	1.72	134.5	754	2,050	15.239
20056	Seine	Jan-Apr	0.00	1.45	16.34	44.33	8.80	22.99	3.90	1.60	0.45	0.15	87.1	2,001	956	10.975
	Gillnet	Jan-Apr	0.00	0.00	0.00	2.77	7.11	59.88	15.22	13.64	1.38	0.00	128.4	506	1,661	12.942

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.3. Age composition and catch by season, fishery and gear type for the Central Coast stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19501	Seine	Oct-Dec	0.00	2.68	28.09	50.52	12.28	5.17	1.20	0.06	0.00	0.00	109.2	3,175	15,508	141.986
	Seine	Jan-Apr	0.06	2.25	31.20	49.36	11.23	4.84	1.06	0.01	0.00	0.00	107.9	2,143	26,950	250.936
19512	Seine	Jan-Apr	0.25	4.61	20.10	29.98	38.50	4.56	1.55	0.40	0.04	0.02	112.7	5,214	33,072	290.690
	Seine	May-Sep	1.11	5.12	19.85	29.75	37.71	4.45	1.52	0.44	0.04	0.02	112.3	5,214 +	123	1.091
19523	Seine	Jan-Apr	0.43	7.65	28.02	24.49	27.28	10.25	1.40	0.48	0.00	0.00	104.9	2,939	768	7.304
19534	Seine	Oct-Dec	0.15	7.31	69.86	17.41	3.99	1.06	0.15	0.00	0.08	0.00	63.6	1,327	6,389	100.473
	Seine	Jan-Apr	0.00	1.72	72.02	21.04	3.91	1.10	0.15	0.00	0.06	0.00	76.2	1,739	18,119	243.703
	Seine	May-Sep	0.07	4.04	69.18	20.52	4.63	1.34	0.16	0.00	0.07	0.00	71.1	3,066 +	109	1.531
19545	Seine	Oct-Dec	0.29	9.94	6.32	77.40	5.10	0.48	0.48	0.00	0.00	0.00	85.4	826	2,559	28.033
	Seine	Jan-Apr	0.00	1.31	5.42	80.39	11.08	1.56	0.25	0.00	0.00	0.00	99.8	1,524	9,035	90.856
19556	Seine	Oct-Dec	0.10	13.79	13.63	11.05	58.24	2.85	0.25	0.10	0.00	0.00	91.4	2,408	22,335	208.767
	Seine	Jan-Apr	0.00	7.39	12.21	8.70	67.86	3.36	0.43	0.00	0.00	0.04	114.2	2,614	21,018	178.311
	Seine	May-Sep	0.04	16.97	13.60	9.12	56.99	2.89	0.34	0.04	0.00	0.02	105.4	5,022 +	275	2.606
19567	Seine	Oct-Dec	0.00	52.32	42.90	3.83	0.55	0.27	0.14	0.00	0.00	0.00	60.1	732	1,788	29.756
	Seine	Jan-Apr	0.00	3.59	52.30	13.98	8.33	20.79	0.98	0.03	0.00	0.00	93.9	3,890	21,002	211.756
	Seine	May-Sep	0.00	23.13	49.84	9.53	5.03	11.85	0.59	0.02	0.00	0.00	79.6	4,622 +	470	5.669
19578	Seine	Oct-Dec	0.00	40.38	49.69	8.01	1.33	0.17	0.42	0.00	0.00	0.00	61.5	2,106	4,928	79.258
	Seine	Jan-Apr	0.00	5.67	73.61	17.35	1.50	1.22	0.65	0.00	0.00	0.00	73.8	1,472	4,454	60.180
	Seine	May-Sep	0.00	47.57	42.11	7.27	2.01	0.42	0.62	0.00	0.00	0.00	64.8	3,578 +	467	8.141
19589	Seine	Oct-Dec	0.17	5.25	49.47	35.94	7.43	0.61	0.57	0.55	0.01	0.00	83.4	2,169	10,774	125.789
	Seine	Jan-Apr	0.00	0.74	47.39	40.66	9.62	0.72	0.52	0.35	0.00	0.00	88.2	2,594	17,096	192.788
19590	Seine	Oct-Dec	0.00	42.87	24.11	26.16	5.59	1.10	0.08	0.08	0.00	0.00	62.1	1,269	3,397	54.675
	Seine	Jan-Apr	0.00	41.51	23.53	27.72	5.86	1.22	0.08	0.08	0.00	0.00	63.7	1,313 +	640	10.054
19601	Seine	Oct-Dec	0.00	64.30	28.81	3.34	2.30	1.25	0.00	0.00	0.00	0.00	51.4	479	956	18.581
	Seine	Jan-Apr	0.00	4.30	32.64	12.80	36.63	12.48	0.94	0.16	0.05	0.00	100.6	2,302	30,641	302.709
	Seine	May-Sep	0.00	16.18	32.43	10.82	29.70	9.92	0.79	0.11	0.04	0.00	91.1	2,781 +	104	1.136
	Trawl	May-Sep	0.00	16.18	32.43	10.82	29.70	9.92	0.79	0.11	0.04	0.00	91.1	2,781 +	4	0.042
19612	Seine	Oct-Dec	0.00	7.65	54.80	20.82	2.85	11.39	2.31	0.18	0.00	0.00	94.1	562 +	677	7.197
	Seine	Jan-Apr	0.00	3.73	51.28	25.17	2.80	13.99	2.80	0.23	0.00	0.00	99.6	429	14,942	150.045
	Seine	May-Sep	0.00	7.65	54.80	20.82	2.85	11.39	2.31	0.18	0.00	0.00	94.1	562 +	90	0.954
19623	Seine	Oct-Dec	0.00	0.36	30.27	58.03	5.25	2.86	3.02	0.21	0.00	0.00	100.6	1,052 +	124	1.232
	Seine	Jan-Apr	0.00	0.35	30.14	58.19	5.18	2.86	3.07	0.21	0.00	0.00	100.6	1,052	43,930	436.570
19634	Seine	Oct-Dec	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1,169 +	3,214	35.288
	Seine	Jan-Apr	0.00	4.88	43.06	35.48	14.65	1.80	0.13	0.00	0.00	0.00	103.4	778	28,288	273.620
	Seine	May-Sep	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1,169 +	165	1.808
	Trawl	Jan-Apr	0.00	14.03	46.96	27.37	10.09	1.45	0.09	0.00	0.00	0.00	91.1	1,169 +	228	2.507
19645	Seine	Oct-Dec	0.00	14.07	37.58	31.01	12.10	5.03	0.18	0.03	0.00	0.00	114.4	1,750 +	1,562	14.266
	Seine	Jan-Apr	0.00	3.62	35.16	37.44	17.59	5.77	0.39	0.03	0.00	0.00	122.3	1,652	12,630	101.310
	Seine	May-Sep	0.00	8.49	36.46	33.62	15.63	5.41	0.33	0.06	0.00	0.00	111.9	1,750 +	1,477	12.553
19656	Seine	Oct-Dec	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0 *	16,217	225.703
	Seine	Jan-Apr	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0 *	19,101	265.835
	Seine	May-Sep	0.00	67.32	20.43	7.33	3.60	1.13	0.19	0.00	0.00	0.00	71.9	0 *	2,163	30.107
19667	Seine	Oct-Dec	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0 *	2,910	33.432
	Seine	Jan-Apr	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0 *	17,206	197.668
	Seine	May-Sep	0.00	37.40	46.19	13.10	2.04	1.02	0.17	0.07	0.01	0.00	87.0	0 *	1,774	20.378
19678	Seine	Oct-Dec	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0 *	497	5.535
	Seine	Jan-Apr	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0 *	309	3.439
	Seine	May-Sep	0.00	32.53	48.02	17.02	2.11	0.25	0.00	0.06	0.00	0.00	89.8	0 *	722	8.043
19690	Seine	Jan-Apr	0.00	54.02	44.42	1.16	0.40	0.00	0.00	0.00	0.00	0.00	73.9	0 *	209	2.832
19701	Seine	Jan-Apr	0.06	12.04	39.34	39.20	4.11	4.33	0.72	0.06	0.13	0.00	108.2	953	3,614	32.684
19712	Seine	Jan-Apr	0.00	3.54	28.25	27.13	27.01	7.57	5.17	1.26	0.08	0.00	120.5	1,763	9,143	74.425
	Gillnet	Jan-Apr	0.00	0.00	2.27	18.18	61.36	11.36	6.82	0.00	0.00	0.00	159.6	44 +	137	0.855
19723	Seine	Jan-Apr	0.00	0.97	48.51	18.90	16.23	12.72	2.02	0.47	0.19	0.00	125.2	1,239	6,664	52.842
	Seine	May-Sep	0.00	1.21	49.64	18.40	15.98	12.11	2.02	0.48	0.16	0.00	124.7	1,239 +	22	0.178
	Gillnet	Jan-Apr	0.00	0.00	4.04	28.28	43.43	21.21	2.02	1.01	0.00	0.00	152.8	99 +	1,113	7.288
19734	Seine	Jan-Apr	0.00	2.94	20.26	42.18	18.05	10.26	5.42	0.71	0.18	0.00	129.5	1,515	3,621	28.835
	Gillnet	Jan-Apr	0.00	0.00	0.42	22.36	38.82	24.47	12.24	1.69	0.00	0.00	158.5	474	5,267	33.230
19745	Seine	Jan-Apr	0.18	0.99	48.84	22.87	19.00	5.33	2.25	0.48	0.04	0.02	119.5	8,923	3,343	31.457
	Gillnet	Jan-Apr	0.00	0.00	4.27	26.40	45.60	15.73	5.60	2.40	0.00	0.00	152.8	375 +	5,395	35.308
19756	Seine	Jan-Apr	0.00	2.18	11.33	41.86	21.86	16.69	4.31	1.52	0.24	0.02	124.4	5,418	6,198	50.662
	Gillnet	Jan-Apr	0.00	0.00	0.86	18.72	30.18	35.12	11.56	3.02	0.44	0.09	162.0	1,222	6,213	38.357
19767	Seine	Jan-Apr	0.00	0.70	17.01	23.32	31.11	17.06	8.70	1.72	0.34	0.05	136.6	2,606	4,201	30.702
	Gillnet	Jan-Apr	0.00	0.00	1.10	13.02	35.54	31.57	13.47	3.97	1.32	0.00	167.7	453	6,904	41.171
19778	Seine	Jan-Apr	0.00	0.19	28.64	16.47	21.54	21.13	8.68	2.56	0.59	0.20	129.6	1,391	4,723	37.629
	Seine	May-Sep	0.00	0.18	29.21	16.70	21.83	20.76	8.28	2.36	0.50	0.17	124.6	1,391 +	46	0.369
	Gillnet	Jan-Apr	0.00	0.00	0.83	8.45	32.10	38.26	16.57	3.21	0.44	0.15	162.1	886	9,277	56.466
19789	Seine	Oct-Dec	0.00	5.70	4.40	31.50	18.70	21.30	15.10	2.80	0.40	0.10	151.8	0 *	0	0.001
	Seine	May-Sep	0.00	5.70	4.40	31.50	18.70	21.30	15.10	2.80	0.40	0.10	151.8	0 *	5	0.031
19790	Seine	Oct-Dec	0.06	5.59	69.33	6.94	9.48	4.51	2.87	0.72	0.42	0.09	91.4	3,345 +	10	0.111
	Seine	Jan-Apr	0.06	5.59	69.33	6.94	9.48	4.51	2.87	0.72	0.42	0.09	91.4	3,345	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	5.36	0.89	34.82	21.43	18.75	11.61	6.25	0.89	157.9	112 +	528	3.347
19801	Seine	Jan-Apr	0.00	1.88	14.92	68.45	7.06	4.98	1.95	0.44	0.29	0.04	101.3	5,210	263	2.570
	Seine	May-Sep	0.00	3.78	14.57	63.82	7.83	6.03	2.60	0.67	0.36	0.13	99.2	5,210 +	6	0.063
	Gillnet	Jan-Apr	0.00	0.28	1.47	47.46	12.43	15.35	12.78	6.94	2.48	0.82	142.5	1,418	2,304	15.892
19812	Seine	Jan-Apr	0.00	0.61	11.52	10.17	66.35	5.52	4.26	1.26	0.30	0.00	131.9	2,300	2,258	17.116
	Seine	May-Sep	0.00	0.61	11.52	10.17	66.35	5.52	4.26	1.26	0.30	0.00	131.9	2,300 +	0	0.003
	Gillnet	Jan-Apr	0.00	0.00	2.88	6.96	76.07	7.38	5.17	1.20	0.33	0.01	141.3	1,242	4,112	29.155

Appendix 1.3. Age composition and catch by season, fishery and gear type for the Central Coast stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19823	Seine	Jan-Apr	0.00	0.58	7.06	13.65	11.15	58.16	5.32	3.13	0.64	0.31	134.7	5,445	2,061	15.154
	Gillnet	Jan-Apr	0.00	0.00	0.56	7.56	13.82	68.06	5.22	3.93	0.62	0.23	146.7	1,703	3,579	24.422
19834	Seine	Jan-Apr	0.00	2.29	5.47	7.67	17.73	17.04	47.03	1.93	0.69	0.14	128.0	6,294	3,589	28.383
	Gillnet	Jan-Apr	0.00	0.00	0.27	2.69	12.49	16.84	61.49	4.63	1.07	0.53	145.1	1,092	3,582	24.536
19845	Seine	Jan-Apr	0.00	0.61	28.72	8.11	9.89	17.28	14.48	20.15	0.49	0.26	136.5	3,690	2,915	20.337
	Gillnet	Jan-Apr	0.00	0.00	3.78	6.27	9.37	20.63	23.57	35.09	0.85	0.44	161.3	1,507	2,294	14.082
19856	Seine	Oct-Dec	0.00	4.00	16.21	39.67	8.61	6.41	6.74	6.12	11.63	0.62	135.0	5,995 +	30	0.224
	Seine	Jan-Apr	0.00	0.94	14.64	41.12	10.95	5.12	6.40	6.55	13.85	0.43	138.7	3,983	2,173	16.047
	Trawl	Jan-Apr	0.00	4.00	16.21	39.67	8.61	6.41	6.74	6.12	11.63	0.62	135.0	5,995 +	7	0.054
	Gillnet	Jan-Apr	0.00	0.00	2.01	21.83	14.45	7.98	14.53	14.47	24.18	0.56	155.5	1,020	1,176	7.676
19867	Seine	Jan-Apr	0.00	4.13	20.03	13.26	32.77	5.60	5.06	6.71	5.11	7.33	143.9	3,614	2,695	18.225
	Gillnet	Jan-Apr	0.00	0.00	0.82	7.75	44.85	11.72	7.85	9.89	8.15	8.97	165.2	981	920	5.571
19878	Seine	Jan-Apr	0.00	0.82	65.84	12.35	6.16	8.30	1.73	1.71	1.68	1.40	107.5	4,159	3,539	31.909
	Seine	May-Sep	0.00	0.81	65.96	12.42	6.14	8.29	1.66	1.73	1.66	1.34	110.9	2,835 +	18	0.162
	Gillnet	Jan-Apr	0.00	0.00	4.39	10.69	15.27	27.48	13.74	7.06	9.73	11.64	162.2	524	970	5.978
19889	Seine	Jan-Apr	0.00	0.84	3.72	79.59	8.59	2.79	2.28	0.60	0.87	0.71	112.1	4,321	6,531	61.253
	Gillnet	Jan-Apr	0.00	0.00	0.32	29.13	25.73	17.31	14.72	5.34	3.72	3.72	147.9	618	2,911	19.680
19890	Seine	Jan-Apr	0.00	0.81	3.55	5.07	74.01	7.47	3.93	3.48	0.81	0.85	131.1	6,843	5,305	39.561
	Gillnet	Jan-Apr	0.00	0.00	0.00	1.03	68.15	16.46	5.46	6.48	1.10	1.32	144.7	806	3,046	20.978
19901	Seine	Jan-Apr	0.00	1.76	16.48	7.41	6.52	56.72	6.70	2.34	1.70	0.36	133.9	7,107	7,097	52.412
	Gillnet	Jan-Apr	0.00	0.00	0.56	2.41	6.30	69.81	9.44	7.04	3.52	0.93	154.7	540	1,806	11.673
19912	Seine	Jan-Apr	0.00	0.94	60.91	10.17	2.47	2.95	19.02	2.03	0.79	0.72	107.2	7,264	7,251	66.620
	Gillnet	Jan-Apr	0.00	0.00	6.87	6.96	4.42	6.98	60.93	9.67	2.99	1.19	155.5	1,119	1,111	6.991
19923	Seine	Jan-Apr	0.00	3.37	7.06	63.75	9.66	1.85	2.41	10.22	1.24	0.43	112.3	6,939	8,478	75.838
	Gillnet	Jan-Apr	0.00	0.00	0.20	45.74	14.12	5.43	5.88	25.47	2.48	0.67	138.9	781	2,038	14.682
19934	Seine	Jan-Apr	0.00	0.87	18.91	7.17	56.09	7.93	2.09	3.02	3.51	0.42	118.7	6,174	9,757	81.704
	Gillnet	Jan-Apr	0.00	0.00	1.73	5.09	66.34	12.30	3.27	4.00	6.51	0.77	133.8	1,951	2,122	15.809
19945	Seine	Jan-Apr	0.00	0.58	5.12	22.95	9.25	49.46	6.30	2.18	2.34	1.81	127.0	8,932	8,131	64.167
	Gillnet	Jan-Apr	0.00	0.00	0.23	8.93	8.00	64.84	10.67	1.79	2.23	3.31	137.4	1,267	1,451	10.565
19956	Seine	Jan-Apr	0.00	12.82	18.28	5.03	16.68	7.26	31.17	5.89	1.57	1.31	124.2	4,087	3,897	32.478
	Gillnet	Jan-Apr	0.00	0.00	0.39	1.55	18.33	11.88	53.07	10.48	1.97	2.33	146.4	566	402	2.743
19967	Seine	Jan-Apr	0.00	2.20	56.77	15.70	3.46	6.65	4.27	8.66	1.70	0.58	94.3	5,235	3,276	34.713
	Gillnet	Jan-Apr	0.00	0.00	1.36	2.92	6.23	22.76	19.26	38.33	7.20	1.95	143.5	514	344	2.401
19978	Seine	Jan-Apr	0.00	0.52	30.62	41.30	7.99	2.46	6.42	5.30	4.48	0.90	97.1	1,339	7,963	81.986
	Gillnet	Jan-Apr	0.00	0.00	0.44	13.09	12.55	8.50	18.31	16.51	22.13	8.46	140.4	1,031	639	4.483
19989	Seine	Jan-Apr	0.00	0.38	8.37	39.70	34.48	7.66	2.22	2.89	2.74	1.55	100.2	3,861	5,940	58.064
	Gillnet	Jan-Apr	0.00	0.00	0.13	15.27	45.02	17.80	6.24	5.31	5.44	4.78	128.8	753	1,524	11.833
19990	Seine	Jan-Apr	0.00	0.19	17.02	10.47	33.07	28.97	6.40	1.46	1.17	1.26	109.3	2,624	6,440	55.631
	Gillnet	Jan-Apr	0.00	0.00	0.44	2.04	40.44	41.61	10.36	1.61	0.88	2.63	133.0	685	926	6.963
20001	Seine	Jan-Apr	0.00	2.00	6.90	24.68	12.46	25.29	21.72	5.20	1.21	0.54	119.7	1,653	5,613	46.878
	Gillnet	Jan-Apr	0.00	0.00	0.00	4.87	5.75	52.75	28.13	7.12	1.13	0.25	135.3	800	517	3.822
20012	Seine	Jan-Apr	0.00	4.71	33.86	9.81	15.67	6.41	19.55	8.17	1.56	0.26	98.5	3,164	2,894	29.155
	Gillnet	Jan-Apr	0.00	0.00	0.60	5.95	20.83	7.54	47.02	16.47	1.39	0.20	128.6	504	399	3.099
20023	Seine	Jan-Apr	0.00	0.09	30.97	24.46	9.95	12.93	5.79	11.12	3.98	0.72	104.9	2,212	2,299	21.911
	Gillnet	Jan-Apr	0.00	0.00	0.43	3.57	11.14	25.73	11.24	33.08	12.32	2.49	143.2	925	289	2.021
20034	Seine	Jan-Apr	0.00	1.27	6.44	65.95	16.06	2.98	3.46	1.74	1.67	0.43	96.1	2,094	2,987	30.986
20045	Seine	Jan-Apr	0.00	0.67	32.35	17.80	35.63	8.73	1.75	1.49	1.12	0.45	92.2	2,680	3,779	40.991
20056	Seine	Jan-Apr	0.00	0.75	9.86	54.21	9.95	20.12	3.39	0.97	0.70	0.04	89.6	2,271	3,072	34.266

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19501	Seine	Oct-Dec	0.03	4.32	58.19	26.93	6.71	1.40	0.30	0.10	0.02	0.00	99.6	7,816	42,180	424.795
	Seine	Jan-Apr	0.06	4.40	32.64	48.59	10.65	2.76	0.62	0.23	0.06	0.00	103.6	1,774 +	1,226	11.828
	Seine	May-Sep	0.04	3.46	61.00	26.57	7.12	1.25	0.43	0.12	0.00	0.00	99.5	7,816 +	393	3.923
19512	Seine	Oct-Dec	0.11	14.85	55.11	21.73	6.50	1.32	0.28	0.08	0.01	0.00	93.0	8,839	44,896	492.871
	Seine	Jan-Apr	0.16	21.32	49.53	21.11	6.19	1.52	0.11	0.05	0.00	0.00	91.8	8,839 +	423	4.847
	Seine	May-Sep	0.03	5.73	55.51	29.95	7.19	1.34	0.20	0.05	0.00	0.00	97.0	8,839 +	527	5.222
	Trawl	Jan-Apr	0.00	0.00	50.26	36.79	9.84	2.59	0.52	0.00	0.00	0.00	115.6	193	0	0.000 -
19523	Seine	Oct-Dec	0.10	1.72	54.76	38.77	3.97	0.52	0.07	0.10	0.00	0.00	87.1	3,810	3,750	41.452
	Seine	Jan-Apr	0.14	3.79	65.35	27.05	2.97	0.62	0.07	0.00	0.00	0.00	81.0	5,220	3,966	48.795
	Seine	May-Sep	0.17	2.60	55.66	37.08	3.71	0.63	0.09	0.07	0.00	0.00	84.6	9,030 +	442	5.059
	Trawl	Oct-Dec	0.00	1.58	63.29	30.79	3.68	0.66	0.00	0.00	0.00	0.00	88.4	760	29	0.326
	Trawl	Jan-Apr	0.00	5.91	67.27	23.62	2.60	0.60	0.00	0.00	0.00	0.00	78.0	999	225	2.888
19534	Seine	Oct-Dec	0.00	1.12	53.97	36.36	6.83	1.38	0.27	0.06	0.01	0.00	96.0	9,693	57,443	595.913
	Seine	Jan-Apr	0.00	2.17	43.19	41.52	8.91	3.32	0.70	0.18	0.01	0.00	94.5	3,618 +	619	6.600
	Seine	May-Sep	0.00	1.78	22.05	37.29	26.45	8.79	2.98	0.60	0.07	0.00	119.9	3,374	7,692	62.447
	Trawl	Jan-Apr	0.00	1.36	52.67	36.83	7.07	1.66	0.33	0.08	0.01	0.00	95.7	9,788 +	14	0.142
19545	Seine	Oct-Dec	0.00	3.92	56.38	33.92	5.18	0.52	0.09	0.00	0.00	0.00	98.5	4,028	50,604	503.361
	Seine	Jan-Apr	0.00	3.50	22.26	60.88	11.00	2.22	0.15	0.00	0.00	0.00	85.6	896	13,825	161.566
	Seine	May-Sep	0.00	4.65	49.87	38.62	5.95	0.82	0.10	0.00	0.00	0.00	94.5	4,924 +	4,207	43.919
	Trawl	Oct-Dec	0.00	4.65	50.12	38.35	5.99	0.80	0.10	0.00	0.00	0.00	95.8	4,994 +	5	0.054
	Trawl	Jan-Apr	0.00	8.57	57.14	25.71	8.57	0.00	0.00	0.00	0.00	0.00	84.7	70	0	0.000 -
19556	Seine	Oct-Dec	0.00	4.07	52.03	30.65	11.30	1.65	0.29	0.00	0.00	0.00	97.4	3,783	44,043	451.810
	Seine	Jan-Apr	0.00	4.10	14.20	29.99	41.94	7.87	1.37	0.43	0.09	0.02	109.1	4,816	26,375	243.982
	Seine	May-Sep	0.00	0.13	9.76	43.52	26.32	17.07	2.44	0.64	0.00	0.13	125.5	779	1,462	11.648
	Trawl	Oct-Dec	0.00	5.52	58.00	26.95	8.19	1.05	0.29	0.00	0.00	0.00	93.7	1,050	182	1.944
	Trawl	Jan-Apr	0.00	18.62	44.38	24.62	10.24	1.91	0.23	0.00	0.00	0.00	85.7	2,197	0	0.000 -
19567	Seine	Oct-Dec	0.00	0.73	64.78	20.31	9.37	4.25	0.51	0.04	0.00	0.00	96.2	4,691	44,241	460.767
	Seine	Jan-Apr	0.00	1.42	64.96	21.83	7.50	3.97	0.31	0.00	0.00	0.00	95.7	826	8,202	84.577
	Seine	May-Sep	0.00	3.46	18.92	40.97	25.30	9.95	1.08	0.11	0.11	0.11	129.9	925	7,165	55.146
	Trawl	Jan-Apr	0.12	2.24	71.93	14.15	4.60	5.66	0.94	0.24	0.00	0.12	91.7	848	0	0.000 -
19578	Seine	Oct-Dec	0.00	10.67	60.24	20.45	3.60	3.20	1.64	0.15	0.04	0.00	88.8	3,085	11,745	133.517
	Seine	Jan-Apr	0.00	9.97	61.67	16.52	4.36	3.66	3.24	0.49	0.09	0.00	90.1	1,850	6,982	84.814
	Seine	May-Sep	0.00	9.00	60.10	21.06	3.99	3.20	2.30	0.30	0.05	0.00	88.9	4,935 +	1,206	13.597
	Trawl	Jan-Apr	0.00	12.72	73.29	11.64	1.88	0.45	0.01	0.01	0.00	0.00	74.8	527	695	9.491
	Gillnet	Jan-Apr	0.00	24.49	53.06	18.37	0.00	2.04	0.00	2.04	0.00	0.00	76.1	49	0	0.000 -
19589	Seine	Oct-Dec	0.74	13.95	66.31	15.95	2.34	0.39	0.21	0.10	0.01	0.00	83.5	7,169	47,601	575.751
	Seine	Jan-Apr	0.86	14.21	65.57	16.41	2.29	0.39	0.21	0.06	0.01	0.00	82.4	7,215 +	146	1.770
	Seine	May-Sep	0.00	25.55	57.59	10.98	3.72	1.52	0.27	0.29	0.09	0.00	79.4	1,506	1,897	23.636
	Trawl	Jan-Apr	1.52	19.81	59.43	18.10	1.14	0.00	0.00	0.00	0.00	0.00	70.9	525	0	0.000 -
	Gillnet	Oct-Dec	0.00	24.49	53.06	18.37	0.00	2.04	0.00	2.04	0.00	0.00	76.1	49 +	381	5.002
19590	Seine	Oct-Dec	0.00	6.80	54.12	35.60	2.93	0.36	0.09	0.07	0.00	0.02	98.1	3,323	67,866	685.617
	Seine	Jan-Apr	0.00	23.34	50.24	24.15	2.11	0.00	0.16	0.00	0.00	0.00	79.8	617	149	1.863
	Trawl	Oct-Dec	0.00	10.10	51.47	34.80	3.07	0.36	0.10	0.08	0.00	0.03	95.7	3,940 +	23	0.237
19601	Seine	Oct-Dec	0.00	40.17	30.91	22.59	5.84	0.50	0.00	0.00	0.00	0.00	88.0	2,248	25,847	303.907
	Seine	Jan-Apr	0.00	31.62	24.51	25.79	16.10	1.87	0.11	0.00	0.00	0.00	80.6	1,145	9,335	115.270
	Seine	May-Sep	0.00	0.16	28.79	22.54	26.29	19.56	2.35	0.31	0.00	0.00	114.2	639	9,119	79.855
	Trawl	Oct-Dec	0.00	38.75	35.27	19.59	6.24	0.15	0.00	0.00	0.00	0.00	85.8	689	1,328	15.472
	Trawl	Jan-Apr	0.00	38.75	35.27	19.59	6.24	0.15	0.00	0.00	0.00	0.00	85.8	689 +	586	6.822
19612	Seine	Oct-Dec	0.00	9.92	71.21	12.79	4.02	1.72	0.33	0.00	0.00	0.00	88.8	2,824	53,725	602.612
	Seine	Jan-Apr	0.00	13.01	67.90	10.71	5.23	2.56	0.60	0.00	0.00	0.00	87.8	2,824 +	36	0.412
	Seine	May-Sep	0.00	9.42	71.71	13.00	3.96	1.57	0.32	0.02	0.00	0.00	88.8	2,824 +	10,747	120.280
	Trawl	Oct-Dec	0.00	9.56	71.49	12.85	4.11	1.59	0.35	0.04	0.00	0.00	89.0	2,824 +	785	8.818
	Trawl	Jan-Apr	0.00	9.56	71.49	12.85	4.11	1.59	0.35	0.04	0.00	0.00	89.0	2,824 +	9	0.106
19623	Seine	Oct-Dec	0.00	13.94	52.76	29.55	3.49	0.19	0.04	0.04	0.00	0.00	86.6	1,596	56,900	651.147
	Seine	Jan-Apr	0.00	31.58	47.44	15.39	2.88	1.78	0.72	0.35	0.00	0.00	82.2	1,874 +	5,014	71.016
	Seine	May-Sep	0.00	16.74	51.99	27.11	3.19	1.26	0.49	0.10	0.00	0.00	83.3	1,874 +	6,685	78.835
	Trawl	Oct-Dec	0.00	16.73	53.03	26.51	2.73	0.65	0.25	0.10	0.00	0.00	84.5	2,014 +	200	2.372
	Trawl	Jan-Apr	0.00	16.73	53.03	26.51	2.73	0.65	0.25	0.10	0.00	0.00	84.5	2,014 +	47	0.562
19634	Seine	Oct-Dec	0.00	4.30	63.37	29.55	2.20	0.47	0.05	0.07	0.00	0.00	103.4	3,255	65,538	626.573
	Seine	Jan-Apr	0.06	5.19	60.54	31.14	2.58	0.40	0.03	0.06	0.00	0.00	105.7	3,255 +	878	8.440
	Seine	May-Sep	0.00	3.41	49.27	36.83	6.34	3.17	0.73	0.24	0.00	0.00	99.2	410	10,153	102.385
	Trawl	Oct-Dec	0.06	5.41	60.55	30.91	2.58	0.40	0.03	0.06	0.00	0.00	103.4	3,255 +	105	1.016
	Trawl	Jan-Apr	0.06	5.41	60.55	30.91	2.58	0.40	0.03	0.06	0.00	0.00	103.4	3,255 +	208	2.011
19645	Seine	Oct-Dec	0.00	20.04	54.60	22.98	2.07	0.28	0.00	0.03	0.00	0.00	103.0	2,555	39,050	388.413
	Seine	Jan-Apr	0.00	20.49	50.36	25.51	2.46	1.14	0.23	0.00	0.00	0.00	104.3	2,939 +	5,453	54.899
	Seine	May-Sep	0.00	16.35	55.51	25.09	2.26	0.77	0.67	0.04	0.00	0.00	104.0	2,939 +	3,266	31.893
	Trawl	Oct-Dec	0.00	14.53	56.86	25.79	2.14	0.61	0.03	0.03	0.00	0.00	104.3	2,939 +	36	0.349
	Trawl	Jan-Apr	0.00	14.53	56.86	25.79	2.14	0.61	0.03	0.03	0.00	0.00	104.3	2,939 +	14	0.132
19656	Seine	Oct-Dec	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529	27,909	231.771
	Seine	Jan-Apr	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	4,216	35.012
	Seine	May-Sep	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	1,165	9.673
	Trawl	Oct-Dec	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	25	0.211
	Trawl	Jan-Apr	0.00	17.20	38.00	25.14	15.88	2.65	1.13	0.00	0.00	0.00	120.4	529 +	18	0.146
19667	Seine	Oct-Dec	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	28,090	306.795
	Seine	Jan-Apr	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	1,694	18.499
	Seine	May-Sep	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	1,193	13.031
	Trawl	Oct-Dec	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	1	0.008
	Trawl	Jan-Apr	0.00	36.90	45.72	12.18	3.21	1.59	0.29	0.05	0.06	0.00	91.6	0 *	65	0.707

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number		CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged		(tonnes)	(millions)
19678	Seine	Oct-Dec	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	*	1,031	10.881
	Seine	Jan-Apr	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	*	58	0.616
	Seine	May-Sep	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	*	700	7.390
	Trawl	Jan-Apr	0.00	30.37	50.62	14.68	3.04	0.88	0.18	0.23	0.00	0.00	94.8	0	*	101	1.061
19690	Seine	Oct-Dec	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0	*	1	0.007
	Seine	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0	*	220	2.299
	Trawl	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0	*	0	0.004
	Gillnet	Jan-Apr	0.00	25.64	60.32	9.49	3.27	0.72	0.56	0.00	0.00	0.00	95.5	0	*	22	0.230
19701	Seine	Oct-Dec	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419		588	5.118
	Seine	Jan-Apr	0.43	13.36	41.17	34.74	7.01	2.58	0.67	0.04	0.00	0.00	113.9	1,419	+	857	7.672
	Seine	May-Sep	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419	+	66	0.577
	Trawl	Oct-Dec	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419	+	95	0.828
	Trawl	Jan-Apr	0.35	12.33	40.03	36.36	7.12	2.82	0.92	0.07	0.00	0.00	114.8	1,419	+	4	0.032
	Gillnet	Oct-Dec	0.00	4.58	11.75	46.61	28.49	6.77	1.49	0.20	0.10	0.00	140.1	1,004	+	40	0.286
	Gillnet	Jan-Apr	0.00	4.58	11.75	46.61	28.49	6.77	1.49	0.20	0.10	0.00	140.1	1,004	+	44	0.311
19712	Seine	Oct-Dec	0.06	12.78	32.57	33.30	16.53	3.36	1.21	0.12	0.06	0.00	126.0	2,340		1,017	8.277
	Seine	Jan-Apr	0.00	5.69	32.75	36.27	19.69	4.21	1.29	0.09	0.01	0.00	113.1	7,062		7,240	63.276
	Seine	May-Sep	0.01	4.41	29.73	34.98	23.32	6.08	1.39	0.09	0.01	0.00	117.3	9,402	+	98	0.815
	Trawl	Jan-Apr	0.01	8.60	34.61	33.23	18.40	3.79	1.17	0.17	0.02	0.00	114.9	9,402	+	0	0.002
	Gillnet	Jan-Apr	0.00	5.92	11.45	45.25	28.69	6.90	1.65	0.14	0.00	0.00	139.8	1,004		456	3.275
19723	Seine	Oct-Dec	0.00	3.37	50.48	20.94	18.35	5.39	0.91	0.45	0.11	0.00	120.6	1,071		256	2.082
	Seine	Jan-Apr	0.08	1.98	36.48	29.31	20.75	10.01	1.24	0.14	0.01	0.00	130.3	4,643		5,161	41.003
	Seine	May-Sep	0.09	3.35	39.83	27.62	19.68	7.90	1.15	0.33	0.05	0.00	124.1	5,714	+	167	1.351
	Trawl	Oct-Dec	0.10	1.89	31.61	30.52	23.07	11.01	1.51	0.26	0.03	0.00	130.6	5,777	+	1	0.008
	Trawl	Jan-Apr	0.10	1.89	31.61	30.52	23.07	11.01	1.51	0.26	0.03	0.00	130.6	5,777	+	0	0.000
	Gillnet	Oct-Dec	0.00	0.00	17.41	30.36	37.50	11.16	3.13	0.45	0.00	0.00	133.4	224	+	6	0.048
	Gillnet	Jan-Apr	0.00	0.00	17.41	30.36	37.50	11.16	3.13	0.45	0.00	0.00	133.4	224	+	2,057	15.421
19734	Seine	Jan-Apr	0.00	16.29	60.29	17.53	4.19	1.47	0.11	0.11	0.00	0.00	77.8	884	+	842	10.833
	Seine	May-Sep	0.00	16.29	60.29	17.53	4.19	1.47	0.11	0.11	0.00	0.00	77.8	884	+	62	0.795
	Trawl	Jan-Apr	0.00	16.83	61.15	17.24	3.42	1.23	0.14	0.00	0.00	0.00	72.2	731		5	0.064
	Gillnet	Jan-Apr	0.00	0.00	3.74	43.04	32.01	17.56	3.21	0.43	0.00	0.00	157.1	924		3.095	19.692
19745	Seine	Oct-Dec	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,685	+	218	2.243
	Seine	Jan-Apr	0.36	3.87	57.31	27.80	7.04	2.49	0.77	0.23	0.13	0.00	98.1	5,685		575	5.995
	Seine	May-Sep	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,685	+	55	0.564
	Trawl	Oct-Dec	1.00	5.07	54.83	26.49	7.34	3.17	1.50	0.44	0.18	0.00	97.1	5,685	+	1	0.006
	Gillnet	Jan-Apr	0.00	0.00	4.88	46.34	32.32	12.80	3.05	0.61	0.00	0.00	150.1	164	+	5,331	35.526
19756	Seine	Oct-Dec	0.06	7.34	23.01	40.08	20.31	5.57	2.38	0.79	0.43	0.04	122.7	3,494		4,313	35.358
	Seine	Jan-Apr	0.00	5.95	20.35	46.41	19.28	5.46	1.60	0.71	0.20	0.04	109.9	2,254		834	7.166
	Seine	May-Sep	0.03	7.45	21.69	41.20	20.01	5.53	2.57	1.04	0.40	0.07	119.8	5,748	+	28	0.238
	Trawl	Oct-Dec	0.03	7.28	21.54	41.65	19.99	5.44	2.59	1.01	0.39	0.07	120.3	5,918	+	3	0.021
19756	Trawl	Jan-Apr	0.03	7.28	21.54	41.65	19.99	5.44	2.59	1.01	0.39	0.07	120.3	5,918	+	86	0.711
	Gillnet	Jan-Apr	0.00	0.00	0.54	42.00	43.88	10.28	2.70	0.40	0.20	0.00	148.8	786		6.975	46.818
19767	Seine	Oct-Dec	0.62	6.52	56.39	19.55	12.05	3.06	0.95	0.66	0.19	0.01	107.2	1,828		616	5.836
	Seine	Jan-Apr	0.06	3.39	52.68	22.31	16.46	3.70	0.86	0.42	0.03	0.09	105.5	3,200		8,257	78.397
	Seine	May-Sep	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028	+	25	0.236
	Trawl	Oct-Dec	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028	+	73	0.683
	Trawl	Jan-Apr	0.36	3.76	52.98	21.04	15.51	4.16	1.25	0.62	0.20	0.12	106.5	5,028	+	802	7.534
	Gillnet	Jan-Apr	0.00	0.00	3.50	27.75	47.32	16.68	4.08	0.54	0.15	0.00	150.3	1,658		7,736	51.507
19778	Seine	Oct-Dec	0.06	2.53	36.75	40.07	9.39	7.18	3.08	0.56	0.35	0.03	110.2	1,984		10,648	96.197
	Seine	Jan-Apr	0.00	0.42	34.65	42.60	13.62	7.09	1.22	0.32	0.00	0.08	105.6	3,516		3,919	36.641
	Seine	May-Sep	0.06	2.25	36.56	39.10	10.46	7.84	2.83	0.57	0.27	0.06	106.3	5,500	+	30	0.287
	Trawl	Oct-Dec	0.03	1.31	35.05	42.37	11.19	7.52	1.95	0.34	0.15	0.08	107.9	5,891	+	1,792	16.618
	Trawl	Jan-Apr	0.03	1.31	35.05	42.37	11.19	7.52	1.95	0.34	0.15	0.08	107.9	5,891	+	296	2.746
	Gillnet	Oct-Dec	0.00	0.00	0.37	20.33	30.50	36.04	10.91	1.48	0.37	0.00	148.9	541	+	63	0.425
	Gillnet	Jan-Apr	0.00	0.00	0.37	20.33	30.50	36.04	10.91	1.48	0.37	0.00	148.9	541		7,253	48.694
19789	Seine	Oct-Dec	0.00	1.62	17.91	38.42	27.23	8.82	4.77	1.01	0.15	0.08	126.5	2,433		10,046	79.075
	Seine	Jan-Apr	0.00	3.01	23.91	33.51	25.54	7.92	3.91	1.48	0.43	0.29	117.7	2,095		54	0.461
	Seine	May-Sep	0.00	2.25	20.19	36.76	25.68	8.39	4.95	1.27	0.31	0.20	120.8	4,528	+	71	0.587
	Trawl	Oct-Dec	0.00	1.04	17.08	39.67	29.98	8.28	2.76	1.04	0.07	0.07	125.5	1,341		2,734	21.790
	Trawl	Jan-Apr	0.00	2.34	21.31	33.82	29.30	8.39	3.55	0.56	0.48	0.24	121.0	1,239		607	5.018
	Gillnet	Oct-Dec	0.00	0.00	1.15	23.14	54.68	13.77	5.54	1.53	0.00	0.19	153.5	523	+	7	0.048
	Gillnet	Jan-Apr	0.00	0.00	1.25	22.00	55.02	14.11	5.74	1.66	0.00	0.21	153.8	523		6,818	44.171
19790	Seine	Oct-Dec	0.30	2.02	42.12	22.71	18.78	9.35	2.56	1.54	0.47	0.15	114.6	3,063		1,188	10.051
	Seine	Jan-Apr	0.00	4.54	41.60	20.45	20.27	9.00	2.55	1.29	0.25	0.05	100.2	7,664		903	9.224
	Seine	May-Sep	0.15	4.03	43.30	19.97	19.34	8.73	2.59	1.42	0.37	0.11	102.3	10,727	+	52	0.514
	Trawl	Oct-Dec	0.00	3.30	46.70	22.21	15.90	8.60	2.01	1.29	0.00	0.00	108.4	698		242	2.234
	Trawl	Jan-Apr	0.00	3.31	49.04	22.17	14.65	7.90	1.78	1.15	0.00	0.00	107.1	785	+	254	2.373
	Gillnet	Oct-Dec	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263	+	0	0.001
	Gillnet	Jan-Apr	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263	+	3,177	21.367
	Gillnet	May-Sep	0.00	0.00	1.52	9.89	44.49	34.22	8.75	0.76	0.38	0.00	148.7	263	+	2	0.017
19801	Seine	Oct-Dec	0.00	4.38	33.94	34.26	14.82	8.57	3.14	0.66	0.21	0.02	116.5	6,355		4,152	34.800
	Seine	Jan-Apr	0.00	6.17	34.93	30.73	11.93	10.58	4.58	0.67	0.37	0.04	99.9	12,461		2,133	19.819
	Seine	May-Sep	0.00	4.80	38.21	36.28	10.06	7.77	2.22	0.46	0.15	0.03	96.4	18,816	+	79	0.813
	Trawl	Oct-Dec	0.26	4.36	39.15	29.90	13.16	7.76	3.57	1.13	0.61	0.09	111.0	1,147		501	4.510
	Trawl	Jan-Apr	0.26	4.36	39.15	29.90	13.16	7.76	3.57	1.13	0.61	0.09	111.0	1,147	+	121	1.087
	Gillnet	Jan-Apr	0.00	0.09	2.19	18.16	22.98	37.37	16.05	2.81	0.26	0.09	152.1	1,140		5.067	33.319

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19812	Seine	Oct-Dec	0.00	5.36	39.98	31.38	14.07	4.96	3.31	0.83	0.06	0.06	121.1	3,876	3,337	27.503
	Seine	Jan-Apr	0.00	7.65	37.90	23.33	19.46	4.51	4.57	2.11	0.40	0.06	104.8	5,332	3,324	30.103
	Seine	May-Sep	0.00	3.86	35.45	28.47	21.36	4.56	4.30	1.74	0.22	0.04	106.8	9,208 +	74	0.690
	Trawl	Oct-Dec	0.00	2.19	46.35	30.29	15.51	2.74	1.64	0.91	0.00	0.36	119.5	548	414	3.464
	Trawl	Jan-Apr	0.00	2.19	46.35	30.29	15.51	2.74	1.64	0.91	0.00	0.36	119.5	548 +	101	0.843
	Gillnet	Jan-Apr	0.00	0.00	4.60	15.77	30.37	15.82	20.42	11.58	1.03	0.41	150.9	589	5,583	37.004
	Gillnet	May-Sep	0.00	0.00	4.58	15.96	30.56	15.11	20.88	11.71	0.85	0.34	151.6	589 +	0	0.001
19823	Seine	Oct-Dec	0.00	3.37	34.06	30.39	16.43	8.12	2.93	3.00	1.43	0.26	116.0	5,296	632	4.809
	Seine	Jan-Apr	0.00	3.36	31.41	28.72	17.68	11.49	3.16	2.78	1.16	0.24	113.5	13,007	7,798	69.556
	Seine	May-Sep	0.00	10.91	42.05	22.39	12.44	7.63	1.95	1.76	0.72	0.14	109.6	18,303 +	57	0.568
	Trawl	Oct-Dec	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439	115	0.797
	Trawl	Jan-Apr	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439	0	0.000
	Trawl	May-Sep	0.00	1.59	19.36	35.99	17.54	12.07	3.87	5.01	3.87	0.68	144.1	439 +	2	0.017
	Gillnet	Jan-Apr	0.00	0.00	0.49	27.76	29.48	23.59	9.34	7.37	1.72	0.25	152.8	407	8,613	56.381
19834	Seine	Oct-Dec	0.21	19.24	36.34	21.19	13.02	6.01	2.80	0.64	0.34	0.22	108.4	3,634	444	3.882
	Seine	Jan-Apr	0.00	4.70	40.35	31.85	11.86	6.31	3.10	1.27	0.44	0.11	103.8	7,318	4,137	41.098
	Seine	May-Sep	0.15	10.57	39.21	27.00	12.16	6.30	3.13	0.95	0.39	0.14	105.9	10,952 +	88	0.843
	Trawl	Oct-Dec	0.12	11.35	38.18	26.45	12.59	6.62	3.17	0.95	0.41	0.16	106.6	10,952 +	113	1.056
	Trawl	Jan-Apr	0.12	11.35	38.18	26.45	12.59	6.62	3.17	0.95	0.41	0.16	106.6	10,952 +	214	2.011
	Gillnet	Jan-Apr	0.00	0.00	7.14	30.29	30.95	19.05	9.39	1.59	0.66	0.93	142.9	756	6,039	42.246
19845	Seine	Oct-Dec	0.00	32.93	37.34	18.72	6.75	2.89	0.91	0.34	0.11	0.00	101.9	2,528	409	3.904
	Seine	Jan-Apr	0.00	23.09	43.51	19.33	8.62	3.55	1.27	0.55	0.07	0.00	90.8	8,187	2,770	29.011
	Seine	May-Sep	0.00	24.05	45.04	18.72	7.69	2.83	1.19	0.42	0.05	0.01	90.3	10,715 +	88	0.975
19845	Trawl	Oct-Dec	0.00	25.68	43.11	18.61	7.60	3.21	1.20	0.51	0.06	0.01	93.7	10,799 +	20	0.218
	Trawl	Jan-Apr	0.00	25.68	43.11	18.61	7.60	3.21	1.20	0.51	0.06	0.01	93.7	10,799 +	246	2.630
	Gillnet	Oct-Dec	0.00	0.09	3.10	26.09	32.48	23.63	9.22	3.74	0.82	0.82	147.4	1,096 +	0	0.002
	Gillnet	Jan-Apr	0.00	0.09	3.10	26.09	32.48	23.63	9.22	3.74	0.82	0.82	147.4	1,096	3,495	23.718
19856	Seine	Oct-Dec	0.00	14.33	62.24	17.57	4.40	1.27	0.17	0.02	0.00	0.00	103.3	1,390	209	2.004
	Seine	Jan-Apr	0.01	9.76	55.76	24.98	6.45	2.06	0.80	0.12	0.08	0.00	94.7	6,773	178	1.844
	Seine	May-Sep	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163 +	40	0.426
	Trawl	Oct-Dec	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163 +	46	0.481
	Trawl	Jan-Apr	0.05	13.71	56.73	21.10	5.75	1.79	0.70	0.12	0.06	0.00	95.2	8,163 +	120	1.257
	Gillnet	Oct-Dec	0.00	0.00	2.50	35.62	33.44	16.51	8.49	2.60	0.57	0.26	145.1	1,920 +	0	0.000
19867	Seine	Oct-Dec	0.10	23.34	34.77	30.50	8.84	1.75	0.46	0.23	0.00	0.00	104.8	1,148	104	0.984
	Seine	Jan-Apr	0.03	2.73	32.98	38.23	19.76	4.32	1.22	0.45	0.19	0.10	97.6	7,957	3,133	32.258
	Seine	May-Sep	0.03	11.92	35.91	34.11	13.52	3.16	0.96	0.27	0.08	0.05	94.2	9,105 +	41	0.431
	Trawl	Jan-Apr	0.03	11.82	33.27	35.95	14.21	3.23	0.99	0.34	0.11	0.05	98.6	9,105 +	76	0.768
	Gillnet	Jan-Apr	0.00	0.00	3.01	38.33	32.48	15.47	7.35	2.55	0.60	0.21	145.3	1,920	5,998	41.166
19878	Seine	Oct-Dec	0.41	6.52	64.47	14.59	11.38	1.81	0.55	0.15	0.11	0.00	106.4	1,632	357	3.386
	Seine	Jan-Apr	0.00	2.35	52.89	17.58	20.29	5.27	1.31	0.21	0.10	0.00	104.0	6,338	1,475	13.516
	Seine	May-Sep	0.07	4.82	61.90	14.59	13.99	3.51	0.87	0.18	0.06	0.00	99.7	7,970 +	33	0.333
	Trawl	Oct-Dec	0.06	4.74	61.47	14.71	14.27	3.60	0.90	0.19	0.06	0.00	100.5	7,970 +	83	0.826
	Trawl	Jan-Apr	0.06	4.74	61.47	14.71	14.27	3.60	0.90	0.19	0.06	0.00	100.5	7,970 +	279	2.773
	Gillnet	Jan-Apr	0.00	0.00	9.20	14.81	47.81	20.09	5.27	2.24	0.34	0.22	144.4	891	5,988	41.461
19889	Seine	Oct-Dec	0.00	26.15	17.44	42.75	6.77	5.90	0.82	0.16	0.00	0.00	109.1	1,252	728	6.660
	Seine	Jan-Apr	0.00	12.31	15.17	51.91	10.87	7.93	1.48	0.27	0.04	0.03	104.6	6,517	1,446	13.339
	Seine	May-Sep	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769 +	56	0.547
	Trawl	Oct-Dec	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769 +	134	1.308
	Trawl	Jan-Apr	0.01	12.64	17.97	51.78	8.95	6.86	1.47	0.28	0.03	0.01	102.2	7,769 +	86	0.844
	Gillnet	Jan-Apr	0.00	0.00	1.60	40.43	21.42	26.02	7.99	2.26	0.28	0.00	140.3	823	5,919	42.236
19890	Seine	Oct-Dec	0.00	6.68	58.62	12.72	17.67	2.26	2.05	0.00	0.00	0.00	101.3	928	75	0.736
	Seine	Jan-Apr	0.00	10.09	57.87	8.23	17.43	3.59	2.27	0.40	0.07	0.06	100.2	5,915	96	0.936
	Seine	May-Sep	0.00	7.51	56.71	11.25	19.33	2.97	1.81	0.34	0.06	0.01	97.4	6,843 +	62	0.632
	Gillnet	Jan-Apr	0.00	0.00	8.93	11.71	56.04	12.10	9.44	1.41	0.30	0.06	141.6	1,371	7,886	55.630
19901	Seine	Oct-Dec	0.00	13.89	31.24	38.58	7.67	7.42	1.04	0.16	0.00	0.00	107.5	698	371	3.440
	Seine	Jan-Apr	0.00	3.82	21.09	44.52	10.27	16.08	2.48	1.47	0.24	0.03	109.4	5,291	1,141	10.217
	Seine	May-Sep	0.00	10.74	23.31	39.87	8.80	13.78	2.05	1.27	0.17	0.02	108.1	5,989 +	58	0.541
	Trawl	Oct-Dec	0.00	10.74	23.31	39.87	8.80	13.78	2.05	1.27	0.17	0.02	108.1	5,989 +	122	1.133
	Gillnet	Jan-Apr	0.00	0.00	1.29	28.15	17.20	40.11	7.27	4.69	1.20	0.09	146.0	1,087	9,410	64.461
19912	Seine	Oct-Dec	0.00	3.96	67.09	17.24	9.27	1.31	0.56	0.56	0.00	0.00	103.6	641	639	6.140
	Seine	Jan-Apr	0.00	3.62	53.63	14.96	17.44	4.04	5.34	0.59	0.38	0.00	105.6	5,036	3,725	34.318
	Seine	May-Sep	0.00	4.95	56.44	14.07	15.80	3.22	4.63	0.58	0.28	0.02	104.1	5,677 +	57	0.550
	Trawl	Oct-Dec	0.00	4.95	56.44	14.07	15.80	3.22	4.63	0.58	0.28	0.02	104.1	5,677 +	128	1.229
	Gillnet	Jan-Apr	0.00	0.00	6.33	14.88	43.63	11.72	18.91	2.65	1.45	0.43	147.6	1,169	8,870	60.081
19923	Seine	Oct-Dec	0.00	26.95	31.11	31.47	6.97	2.56	0.26	0.58	0.11	0.00	98.6	973	516	5.272
	Seine	Jan-Apr	0.00	11.22	39.18	33.15	7.57	5.77	1.37	1.63	0.06	0.06	101.3	5,445	4,396	42.070
	Seine	May-Sep	0.00	16.80	36.80	31.55	6.87	5.28	1.20	1.32	0.14	0.03	99.6	6,418 +	96	0.968
	Gillnet	Jan-Apr	0.00	0.00	11.47	40.02	16.98	21.61	4.08	5.40	0.22	0.22	137.9	907	8,733	63.326
19934	Seine	Oct-Dec	0.00	5.65	50.00	25.43	16.30	1.52	1.09	0.00	0.00	0.00	101.3	460	866	8.549
	Seine	Jan-Apr	0.02	3.72	42.96	26.98	19.34	3.70	2.65	0.53	0.13	0.00	97.2	5,969	5,138	52.868
	Seine	May-Sep	0.02	4.74	42.74	26.61	18.59	3.81	2.69	0.65	0.14	0.00	97.4	6,429 +	71	0.730
	Gillnet	Jan-Apr	0.00	0.07	3.65	25.26	44.78	15.21	7.83	2.42	0.62	0.16	133.7	1,201	11,572	86.661
19945	Seine	Oct-Dec	0.00	20.87	27.81	36.05	10.01	4.44	0.68	0.11	0.00	0.02	102.9	1,130	604	5.865
	Seine	Jan-Apr	0.00	7.09	21.21	37.04	18.67	11.51	2.92	1.13	0.35	0.08	110.4	5,754	4,362	38.990
	Seine	May-Sep	0.00	11.65	22.69	35.69	16.39	9.89	2.37	0.93	0.29	0.10	107.9	6,884 +	33	0.306
	Gillnet	Jan-Apr	0.00	0.00	2.10	27.82	38.15	24.14	5.10	2.10	0.30	0.30	139.6	927	8,190	58.655
19956	Seine	Oct-Dec	0.49	29.31	46.92	11.70	8.84	1.78	0.87	0.08	0.00	0.00	85.9	1,662	397	4.650
	Seine	Jan-Apr	0.06	9.29	47.72	15.20	15.88	6.74	3.87	0.86	0.27	0.11	98.2	8,243	7,434	73.620
	Seine	May-Sep	0.08	14.92	48.51	13.72	13.62	5.27	3.01	0.61	0.19	0.07	95.1	9,905 +	10	0.106

Appendix 1.4. Age composition and catch by season, fishery and gear type for the Strait of Georgia stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
	Trawl	Oct-Dec	0.08	14.92	48.51	13.72	13.62	5.27	3.01	0.61	0.19	0.07	95.1	9,905 +	39	0.406
	Gillnet	Jan-Apr	0.00	0.00	4.05	15.87	44.53	22.08	10.30	2.11	0.84	0.21	138.2	544	6,233	45.214
19967	Seine	Oct-Dec	3.29	9.71	54.01	21.40	5.31	5.27	2.24	1.24	0.14	0.16	88.1	7,667 +	279	3.120
	Seine	Jan-Apr	0.00	5.52	51.35	24.45	6.54	7.43	2.84	1.70	0.12	0.04	88.8	7,297	9,390	96.287
	Seine	May-Sep	0.65	8.74	52.26	22.45	5.78	6.09	2.41	1.42	0.13	0.07	91.7	7,667 +	7	0.071
	Gillnet	Jan-Apr	0.00	0.00	4.74	17.85	16.43	31.91	17.06	8.53	2.53	0.95	136.7	633	6,148	44.974
19978	Seine	Oct-Dec	0.00	3.96	48.07	40.23	6.40	0.91	0.34	0.08	0.00	0.00	86.1	1,288	954	11.072
	Seine	Jan-Apr	0.02	2.93	47.03	31.80	12.25	2.90	2.14	0.70	0.21	0.03	86.8	5,837	5,755	66.260
	Trawl	Jan-Apr	0.00	7.01	45.19	37.03	8.16	1.14	0.98	0.16	0.33	0.00	74.3	613	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	1.54	26.20	28.32	15.61	18.69	7.13	1.54	0.96	130.4	519	6,895	52.858
19989	Seine	Oct-Dec	0.17	12.30	27.77	43.17	13.35	2.74	0.37	0.13	0.00	0.00	91.3	1,297	1,471	16.123
	Seine	Jan-Apr	0.00	4.23	22.78	45.02	18.55	6.58	1.88	0.78	0.13	0.06	100.0	3,192	4,976	49.748
	Trawl	Jan-Apr	0.00	5.49	31.87	30.77	21.98	7.69	1.10	0.00	1.10	0.00	92.3	91	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	2.15	29.31	36.72	21.05	6.70	3.35	0.60	0.12	130.8	836	6,837	52.248
19990	Seine	Oct-Dec	0.00	21.12	50.16	16.69	8.74	2.39	0.89	0.00	0.00	0.00	75.0	1,077	1,156	15.363
	Seine	Jan-Apr	0.10	9.62	35.44	19.34	23.92	8.81	2.12	0.36	0.28	0.02	92.2	5,042	6,454	69.966
	Gillnet	Jan-Apr	0.00	0.00	1.07	13.75	44.56	28.68	9.59	1.92	0.43	0.00	135.1	938	7,593	56.219
20001	Seine	Oct-Dec	0.00	9.66	51.94	27.98	5.52	3.51	1.25	0.00	0.13	0.00	95.6	797	1,423	14.897
	Seine	Jan-Apr	0.00	4.80	42.65	30.65	9.52	9.19	2.52	0.55	0.09	0.02	97.3	4,558	7,275	74.770
	Gillnet	Jan-Apr	0.00	0.00	3.55	17.75	25.59	35.06	15.09	2.37	0.30	0.30	133.4	676	7,682	57.589
20012	Seine	Oct-Dec	0.00	4.96	61.42	26.19	5.93	0.97	0.32	0.11	0.00	0.11	87.0	928	1,328	15.265
	Seine	Jan-Apr	0.00	6.59	49.18	27.04	12.45	2.35	1.99	0.40	0.00	0.00	87.7	4,475	9,299	106.015
	Gillnet	Jan-Apr	0.00	0.00	5.83	20.78	30.42	17.69	21.01	3.54	0.49	0.24	131.8	915	7,986	60.800
20023	Seine	Oct-Dec	0.00	2.80	44.16	42.29	8.41	2.10	0.23	0.00	0.00	0.00	91.9	428	1,696	18.466
	Seine	Jan-Apr	0.01	2.67	42.62	36.58	12.64	4.03	0.93	0.41	0.10	0.00	87.2	7,293	10,670	122.311
	Gillnet	Jan-Apr	0.00	0.00	2.29	22.38	31.05	23.83	9.87	7.34	2.65	0.60	131.6	831	8,010	60.889
20034	Seine	Oct-Dec	0.00	11.24	30.77	40.04	14.00	3.55	0.39	0.00	0.00	0.00	83.1	507	1,356	16.316
	Seine	Jan-Apr	0.00	2.90	25.39	41.55	22.29	5.65	1.54	0.43	0.25	0.00	83.1	1,707	7,019	79.437
	Gillnet	Jan-Apr	0.00	0.00	1.74	21.39	37.02	23.98	11.72	2.51	1.49	0.14	124.0	1,185	5,226	41.630
20045	Seine	Oct-Dec	0.05	9.02	31.32	28.33	20.85	7.92	1.94	0.44	0.10	0.03	87.7	5,135 +	1,332	15.157
	Seine	Jan-Apr	0.00	4.00	23.82	31.66	28.26	8.73	2.30	0.85	0.28	0.09	95.6	3,174	7,929	82.942
	Gillnet	Jan-Apr	0.00	0.00	0.88	12.91	46.61	24.07	10.28	3.72	1.31	0.22	130.6	457	8,954	68.542
20056	Seine	Oct-Dec	0.33	23.95	30.75	23.55	11.93	7.30	1.88	0.83	0.31	0.01	79.5	4,891 +	1,371	17.913
	Seine	Jan-Apr	0.07	16.89	24.93	24.50	18.98	11.05	2.44	0.89	0.21	0.04	84.5	2,824	9,308	110.102
	Gillnet	Jan-Apr	0.00	0.00	0.62	12.22	35.80	33.54	14.70	2.49	0.62	0.00	129.8	810	7,277	56.028

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
~ No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix 1.5. Age composition and catch by season, fishery and gear type for the West Coast Vancouver Island stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number		CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged		(tonnes)	(millions)
19501	Seine	Oct-Dec	0.10	15.78	39.08	37.78	5.35	1.56	0.26	0.05	0.05	0.00	96.8	1,927		7,670	79.266
	Seine	Jan-Apr	0.00	10.19	36.69	43.89	7.69	1.25	0.30	0.00	0.00	0.00	99.3	2,112		14,151	143.353
19512	Seine	Oct-Dec	0.11	6.62	61.99	20.85	9.27	0.89	0.27	0.00	0.00	0.00	98.9	996		8,251	83.215
	Seine	Jan-Apr	0.00	0.33	12.08	27.32	50.77	6.88	2.08	0.48	0.06	0.00	123.8	3,897		18,757	146.019
19523	Seine	Jan-Apr	0.16	11.77	57.76	28.08	1.67	0.50	0.05	0.00	0.00	0.00	82.4	3,764		20	0.242
19534	Seine	Oct-Dec	0.05	1.61	61.40	29.42	6.70	0.59	0.12	0.12	0.00	0.00	95.6	3,655		23,534	245.938
	Seine	Jan-Apr	0.00	4.43	65.53	24.81	4.06	0.83	0.21	0.04	0.04	0.04	87.2	2,439		9,675	109.814
19545	Seine	Oct-Dec	0.06	19.64	57.81	18.59	3.27	0.64	0.00	0.00	0.00	0.00	87.6	1,723		4,650	53.117
	Seine	Jan-Apr	0.00	10.86	65.09	20.01	3.47	0.52	0.05	0.00	0.00	0.00	80.9	754		1,473	18.369
19556	Seine	Oct-Dec	0.00	13.43	67.98	14.82	3.09	0.50	0.16	0.02	0.00	0.00	87.4	3,730		15,310	175.972
	Seine	Jan-Apr	0.00	9.21	49.51	19.28	17.88	3.68	0.11	0.11	0.22	0.00	87.2	923		1,787	20.496
19567	Seine	Oct-Dec	0.00	2.86	71.84	24.69	0.41	0.20	0.00	0.00	0.00	0.00	86.4	490	+	1,690	19.549
	Seine	Jan-Apr	0.00	2.74	71.92	24.81	0.35	0.18	0.00	0.00	0.00	0.00	86.4	588	+	915	10.586
	Seine	May-Sep	0.00	2.72	71.94	24.83	0.34	0.17	0.00	0.00	0.00	0.00	86.4	588	+	8	0.088
19578	Seine	Jan-Apr	0.00	15.18	54.28	25.87	3.98	0.47	0.17	0.04	0.01	0.00	76.8	1,480		513	6.766
	Seine	May-Sep	0.00	13.04	52.03	25.41	5.47	2.30	1.35	0.34	0.07	0.00	78.3	1,480	+	43	0.551
19589	Seine	Oct-Dec	0.00	3.26	45.21	29.96	14.51	3.46	1.82	1.45	0.33	0.00	92.2	2,843		55,196	588.911
	Seine	Jan-Apr	0.00	3.28	19.68	23.88	26.94	9.15	7.94	6.52	1.99	0.62	99.6	751		13,845	136.204
	Gillnet	Jan-Apr	0.00	10.00	58.10	9.50	19.00	2.60	0.50	0.20	0.10	0.00	97.6	0	*	182	1.868
19590	Seine	Oct-Dec	0.00	8.92	54.85	23.26	8.64	2.81	0.95	0.35	0.14	0.07	95.7	2,846		53,911	563.328
	Seine	Jan-Apr	0.00	8.92	54.85	23.26	8.64	2.81	0.95	0.35	0.14	0.07	95.7	2,846		0	0.000
19601	Seine	Oct-Dec	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590	+	16,711	195.384
	Seine	Jan-Apr	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590	+	9,679	113.162
	Seine	May-Sep	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590	+	44	0.520
19612	Seine	Oct-Dec	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1,163	+	5,951	63.821
	Seine	Jan-Apr	0.00	5.32	80.46	10.07	3.10	1.05	0.00	0.00	0.00	0.00	92.8	1,117		17,710	190.890
	Trawl	Jan-Apr	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1,163	+	24	0.253
19623	Seine	Oct-Dec	0.00	1.99	43.18	48.71	5.16	0.75	0.21	0.00	0.00	0.00	101.3	1,862	+	3,184	31.449
	Seine	Jan-Apr	0.00	2.47	41.39	49.75	5.41	0.71	0.27	0.00	0.00	0.00	101.0	1,633		15,022	148.723
19634	Seine	Oct-Dec	0.00	1.64	60.61	25.86	10.83	0.77	0.29	0.00	0.00	0.00	103.4	1,107	+	2,952	28.550
	Seine	Jan-Apr	0.00	0.95	65.05	22.91	10.00	0.85	0.25	0.00	0.00	0.00	101.0	769		18,313	182.208
19645	Seine	Oct-Dec	0.00	2.78	34.38	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576	+	68	0.553
	Seine	Jan-Apr	0.00	2.78	34.37	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576		10,397	84.858
	Seine	May-Sep	0.00	2.78	34.37	48.44	10.07	3.99	0.35	0.00	0.00	0.00	122.5	576	+	5,582	45.559
19656	Seine	Oct-Dec	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0	*	4,299	31.377
	Seine	Jan-Apr	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0	*	6,471	47.228
	Seine	May-Sep	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0	*	73	0.535
19667	Seine	Oct-Dec	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0	*	2,965	25.811
	Seine	Jan-Apr	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0	*	9,794	85.253
	Seine	May-Sep	0.00	12.86	60.28	20.52	4.84	1.15	0.18	0.01	0.02	0.00	114.9	0	*	2,385	20.760
19701	Seine	Jan-Apr	0.00	5.77	44.57	36.95	7.85	2.77	1.62	0.46	0.00	0.00	132.8	433		0	0.000
19712	Seine	Jan-Apr	0.00	3.66	19.01	50.10	21.81	3.39	1.23	0.79	0.03	0.00	135.3	1,482		6,894	51.001
19723	Seine	Jan-Apr	0.00	0.21	25.15	23.05	35.64	13.81	1.89	0.17	0.08	0.00	139.1	2,556		16,766	117.326
	Gillnet	Jan-Apr	0.00	0.00	8.81	23.56	51.44	12.23	3.06	0.72	0.18	0.00	159.4	556		1,537	9.642
19734	Seine	Jan-Apr	0.00	5.71	43.66	22.09	15.14	10.96	2.32	0.12	0.00	0.00	114.9	5,221		12,394	109.083
	Gillnet	Jan-Apr	0.00	0.00	29.87	27.92	27.92	10.39	3.90	0.00	0.00	0.00	133.5	154	+	3,940	29.517
19745	Seine	Jan-Apr	0.02	0.44	51.61	19.95	12.00	8.70	5.71	1.38	0.18	0.00	124.6	10,038		17,798	142.327
	Trawl	Jan-Apr	0.02	0.60	53.85	19.75	11.36	8.01	4.96	1.28	0.17	0.01	122.5	10,038	+	0	0.004
	Gillnet	Jan-Apr	0.00	0.00	2.90	32.37	36.51	19.92	7.88	0.41	0.00	0.00	169.0	241	+	8,310	49.159
19756	Seine	Jan-Apr	0.00	0.20	8.31	48.06	19.79	12.97	7.65	2.57	0.43	0.00	140.0	9,230		22,820	162.893
	Trawl	Jan-Apr	0.00	0.47	14.55	54.46	18.78	6.10	5.16	0.47	0.00	0.00	131.6	213		0	0.000
	Gillnet	Jan-Apr	0.00	0.00	0.68	41.72	34.00	14.77	5.92	2.50	0.33	0.08	150.2	1,199		16,005	106.418
19767	Seine	Jan-Apr	0.00	0.39	11.51	32.16	38.00	12.43	3.89	1.42	0.16	0.03	136.7	6,684		17,463	126.700
	Gillnet	Jan-Apr	0.00	0.60	3.61	17.47	43.37	16.87	11.14	5.12	1.51	0.30	154.2	332	+	12,556	81.452
	Gillnet	May-Sep	0.00	0.60	3.61	17.47	43.37	16.87	11.14	5.12	1.51	0.30	154.2	332	+	24	0.154
19778	Seine	Oct-Dec	0.00	0.00	31.00	23.75	15.00	22.50	4.25	1.50	1.00	1.00	127.3	400		303	2.379
	Seine	Jan-Apr	0.00	0.77	39.43	18.78	16.78	18.80	4.14	1.10	0.17	0.04	109.2	7,454		7,615	67.761
	Seine	May-Sep	0.00	0.80	41.49	19.07	15.66	17.60	3.85	1.18	0.23	0.11	111.9	7,854	+	7	0.066
	Trawl	Oct-Dec	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7,898	+	51	0.456
19778	Trawl	Jan-Apr	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7,898	+	3	0.023
	Trawl	May-Sep	0.00	0.80	41.63	19.02	15.66	17.52	3.85	1.18	0.23	0.11	111.8	7,898	+	11	0.101
	Gillnet	Jan-Apr	0.00	0.00	1.42	5.45	21.33	49.05	17.54	4.74	0.24	0.24	157.6	422		14,755	93.615
19789	Seine	Oct-Dec	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3,689	+	70	0.563
	Seine	Jan-Apr	0.00	1.07	14.94	51.51	13.82	9.87	7.04	1.43	0.26	0.06	123.1	3,689		10,473	86.211
	Seine	May-Sep	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3,689	+	4	0.032
	Trawl	Oct-Dec	0.00	0.81	13.91	50.09	14.23	10.79	7.94	1.60	0.52	0.11	124.5	3,689	+	9	0.073
	Gillnet	Jan-Apr	0.00	0.00	1.05	24.79	28.57	23.74	18.07	3.15	0.42	0.21	161.5	476		8,138	50.388
19790	Seine	Jan-Apr	0.00	7.13	37.93	13.75	20.24	8.99	8.11	3.14	0.48	0.23	110.8	3,735		1,682	14.641
	Seine	May-Sep	0.00	6.21	43.91	15.58	20.00	6.37	5.30	2.20	0.35	0.08	108.2	3,735	+	0	0.000
	Gillnet	Jan-Apr	0.00	0.00	0.00	5.31	52.51	22.35	12.01	7.26	0.28	0.28	163.6	358	+	2,300	14.061
19801	Seine	Jan-Apr	0.00	3.89	32.52	33.31	10.62	13.65	4.07	1.51	0.37	0.05	116.1	5,026		5,008	44.277
	Seine	May-Sep	0.00	2.83	27.39	22.26	14.13	17.84	8.83	4.77	1.41	0.53	133.6	566		2	0.015
	Gillnet	Jan-Apr	0.00	0.00	1.78	21.00	14.95	36.30	18.86	7.12	0.00	0.00	148.6	281	+	3,079	20.725
19812	Seine	Jan-Apr	0.00	4.32	24.84	28.55	22.53	5.50	7.92	3.73	2.04	0.58	120.4	4,775		2,370	19.713
	Seine	May-Sep	0.00	3.27	23.96	27.41	26.05	5.45	9.51	2.72	1.36	0.27	115.9	4,775	+	2	0.013
	Gillnet	Jan-Apr	0.00	0.00	0.70	12.02	44.25	11.67	27.53	3.31	0.35	0.17	137.0	574		3,115	22.741

Appendix 1.5. Age composition and catch by season, fishery and gear type for the West Coast Vancouver Island stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19823	Seine	Jan-Apr	0.00	3.83	19.37	23.62	23.39	16.69	4.60	5.45	1.50	1.55	131.3	3,188	6,141	45.840
	Gillnet	Jan-Apr	0.00	0.00	0.35	14.19	23.82	44.83	6.48	9.81	0.35	0.18	137.8	571	2,434	17.662
19834	Seine	Jan-Apr	0.00	23.09	37.97	13.00	8.86	9.48	5.52	0.88	1.00	0.19	114.9	3,079	5,718	49.965
	Gillnet	Jan-Apr	0.00	0.00	1.68	6.72	17.98	32.61	31.93	5.38	3.36	0.34	154.9	595	858	5.540
19845	Seine	Jan-Apr	0.00	6.28	48.74	22.86	6.40	5.12	6.21	3.47	0.37	0.55	120.1	2,995	177	1.352
	Seine	May-Sep	0.00	20.47	53.62	14.22	3.71	2.74	3.17	1.70	0.13	0.23	109.0	2,995 +	1	0.008
19856	Seine	Oct-Dec	0.00	3.78	50.45	29.70	8.29	3.13	2.24	1.76	0.58	0.07	121.5	4,151 +	1	0.005
	Seine	Jan-Apr	0.00	3.86	48.16	27.50	10.68	3.83	2.92	2.21	0.74	0.11	124.3	2,847	203	1.633
19867	Seine	Jan-Apr	0.00	16.21	16.21	36.29	18.16	7.70	2.56	1.38	1.15	0.34	130.8	3,480	13,463	102.956
	Trawl	Jan-Apr	0.00	26.98	26.03	28.57	13.65	1.59	0.95	1.90	0.32	0.00	93.9	315	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	1.82	24.55	61.82	5.45	2.18	2.91	0.91	0.36	171.3	550	2,471	14.431
19878	Seine	Jan-Apr	0.00	1.60	63.80	7.41	14.70	8.38	2.75	0.65	0.48	0.23	127.5	4,883	8,276	67.129
	Trawl	Jan-Apr	0.00	3.03	59.09	19.70	15.15	3.03	0.00	0.00	0.00	0.00	92.9	66	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	5.38	7.10	41.29	28.60	12.90	3.01	1.29	0.43	166.9	465	1,448	8.674
19889	Seine	Jan-Apr	0.00	3.06	14.96	61.92	7.11	8.47	3.45	0.79	0.17	0.07	126.4	4,178	9,774	77.304
	Trawl	Jan-Apr	0.00	0.00	14.29	63.10	10.71	9.52	2.38	0.00	0.00	0.00	127.4	84	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	0.20	54.50	11.00	22.30	9.40	1.60	1.00	0.00	151.0	382 +	3,515	23.274
19890	Seine	Jan-Apr	0.00	0.46	26.32	11.72	48.79	4.89	5.99	1.53	0.27	0.03	139.4	3,720	7,890	56.611
	Gillnet	Jan-Apr	0.00	0.00	1.35	7.87	68.99	8.31	10.34	2.47	0.67	0.00	155.6	445	1,959	12.593
19901	Seine	Jan-Apr	0.00	6.15	19.13	22.02	10.60	35.06	2.99	3.39	0.64	0.02	130.8	5,715	6,299	47.096
	Gillnet	Jan-Apr	0.00	0.00	3.26	6.84	12.70	64.50	6.84	8.14	6.52	0.00	175.5	307 +	2,336	13.308
19912	Seine	Jan-Apr	0.00	1.47	43.29	10.77	14.97	6.62	18.95	2.42	1.26	0.26	132.2	4,290	3,086	23.337
	Trawl	Jan-Apr	0.00	3.45	31.03	20.69	26.44	2.30	10.34	2.30	2.30	1.15	105.6	87	0	0.000 -
	Gillnet	Jan-Apr	0.00	0.00	6.29	13.49	30.76	13.85	29.86	2.88	2.52	0.36	154.2	556	627	4.066
19923	Seine	Jan-Apr	0.00	3.46	26.25	39.83	7.14	8.29	4.57	8.71	1.08	0.66	126.9	4,705	5,612	44.244
19934	Seine	Jan-Apr	0.00	3.85	18.47	22.30	31.82	8.69	6.19	6.58	1.84	0.27	125.3	6,196	5,332	42.481
	Trawl	Oct-Dec	0.00	3.00	22.74	24.13	30.04	8.00	5.00	5.26	1.58	0.24	124.7	6,274 +	0	0.001
	Trawl	Jan-Apr	0.00	6.41	25.64	37.18	12.82	12.82	3.85	0.00	1.28	0.00	92.4	78	0	0.000 -
	Trawl	May-Sep	0.00	0.79	26.11	29.11	26.58	7.91	5.38	2.85	1.11	0.16	97.1	632	1	0.008
	Gillnet	Jan-Apr	0.00	0.16	5.65	32.10	54.84	5.32	1.13	0.65	0.16	0.00	131.1	620	706	5.381
19945	Seine	Jan-Apr	0.00	1.02	13.98	21.55	19.83	27.32	7.46	4.66	3.26	0.93	139.0	5,392	1,947	14.006
	Trawl	Oct-Dec	0.00	1.17	13.32	25.60	20.52	25.29	6.44	4.02	2.89	0.75	135.6	7,086 +	1	0.005
	Trawl	May-Sep	0.00	2.57	34.57	29.07	10.02	13.75	4.52	3.93	1.57	0.00	105.9	574	3	0.029
19956	Seine	Jan-Apr	0.00	17.06	22.43	12.83	15.22	12.76	14.03	3.39	1.42	0.86	119.3	5,394	790	6.607
	Trawl	Oct-Dec	0.00	14.66	22.14	12.66	19.38	12.53	13.75	2.82	1.25	0.81	119.5	8,255 +	1	0.006
	Trawl	May-Sep	0.00	14.66	22.14	12.66	19.38	12.53	13.75	2.82	1.25	0.81	119.5	8,255 +	0	0.000
19967	Seine	Jan-Apr	0.00	3.65	70.44	8.47	4.17	5.11	4.02	3.18	0.63	0.32	98.6	6,539	6,656	67.506
19978	Seine	Jan-Apr	0.00	2.40	21.91	61.07	6.56	2.75	2.40	1.65	0.98	0.29	99.1	6,098	5,449	55.784
	Gillnet	Jan-Apr	0.00	0.00	0.86	41.37	10.51	10.55	14.67	12.41	6.33	3.29	138.6	899	1,550	11.177
19989	Seine	Jan-Apr	0.00	1.39	21.95	23.61	39.60	8.41	2.67	1.29	0.73	0.33	110.5	4,341	3,407	31.759
	Gillnet	Jan-Apr	0.00	0.00	0.82	9.98	60.36	18.46	5.32	3.35	1.48	0.24	135.7	1,043	963	7.098
19990	Seine	Jan-Apr	0.00	7.85	24.06	19.88	17.32	25.46	3.65	1.07	0.58	0.13	115.1	6,613	926	8.308
	Gillnet	Jan-Apr	0.00	0.00	1.28	7.52	27.04	52.80	6.24	2.56	2.24	0.32	145.2	625	700	4.823
20001	Seine	Jan-Apr	0.00	7.02	45.66	20.20	8.38	7.57	9.44	1.32	0.21	0.21	105.3	2,352	0	0.000 -
20012	Seine	Jan-Apr	0.00	4.14	51.73	22.77	9.91	3.00	4.36	3.73	0.36	0.00	103.0	2,200	433	4.204
	Gillnet	Jan-Apr	0.00	0.00	0.00	10.28	28.79	15.33	20.56	22.43	2.24	0.37	152.3	535	388	2.550
20023	Seine	Jan-Apr	0.00	1.13	38.66	39.14	14.95	2.87	1.45	0.88	0.79	0.11	105.7	4,309	2,571	24.345
	Gillnet	Jan-Apr	0.00	0.00	2.61	17.43	31.86	19.84	9.82	12.83	5.01	0.60	146.7	499	945	6.444
20034	Seine	Jan-Apr	0.00	1.32	13.73	52.30	22.60	7.34	1.89	0.51	0.27	0.03	104.1	2,956	3,861	37.106
	Gillnet	Jan-Apr	0.00	0.00	0.79	28.37	24.41	25.04	14.58	3.80	2.22	0.79	137.2	631	593	4.324
20045	Seine	Jan-Apr	0.00	1.09	33.21	23.84	27.65	9.92	3.45	0.60	0.12	0.12	100.5	1,653	3,373	33.573
	Gillnet	Jan-Apr	0.00	0.00	0.80	10.80	49.80	23.80	10.60	3.80	0.20	0.20	127.5	500	896	7.032
20056	Seine	Jan-Apr	0.00	15.08	37.26	33.54	7.89	5.37	0.78	0.09	0.00	0.00	78.8	1,154	0	0.000 -

Appendix 1.6. Age composition and catch by season, fishery and gear type for the Area 27 stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE										Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19534	Seine	Jan-Apr	0.03	2.56	62.55	28.12	5.74	0.69	0.19	0.08	0.02	0.02	92.9	6,361 +	1,920	20.667
19545	Seine	Oct-Dec	0.00	2.77	35.29	52.50	7.55	1.48	0.33	0.08	0.00	0.00	99.0	1,412	5,939	58.757
	Seine	Jan-Apr	0.00	6.80	34.77	49.72	6.94	1.42	0.28	0.07	0.00	0.00	96.7	1,412	0	0.000 ~
19589	Seine	Jan-Apr	0.00	4.12	44.71	27.63	14.44	3.90	2.45	2.06	0.58	0.11	93.3	3,594 +	407	4.366
19601	Seine	Jan-Apr	0.00	38.31	37.97	19.15	4.41	0.17	0.00	0.00	0.00	0.00	85.5	590 +	1,149	13.434
19612	Seine	Jan-Apr	0.00	4.82	82.29	9.63	2.41	0.86	0.00	0.00	0.00	0.00	93.2	1,163 +	173	1.856
19623	Seine	Jan-Apr	0.00	1.99	43.18	48.71	5.16	0.75	0.21	0.00	0.00	0.00	101.3	1,862 +	31	0.304
19634	Seine	Jan-Apr	0.00	1.33	59.98	26.04	11.56	0.83	0.25	0.00	0.00	0.00	103.7	1,202 +	323	3.110
19645	Seine	Jan-Apr	0.00	2.51	31.20	46.10	14.62	4.60	0.42	0.28	0.28	0.00	125.8	718 +	769	6.113
19656	Seine	Oct-Dec	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	125	0.913
	Seine	Jan-Apr	0.00	13.59	26.83	26.12	23.17	9.07	1.23	0.00	0.00	0.00	137.0	0 *	826	6.032
19667	Seine	Jan-Apr	2.43	20.71	55.46	16.68	3.43	0.80	0.26	0.19	0.04	0.00	106.7	0 *	51	0.482
19701	Seine	Jan-Apr	0.00	19.86	30.14	40.41	4.79	2.05	1.37	0.68	0.68	0.00	131.8	146	0	0.000 ~
19734	Seine	Jan-Apr	0.00	8.03	43.12	23.94	13.56	8.83	2.23	0.22	0.04	0.02	111.3	5,389 +	508	4.562
	Gillnet	Jan-Apr	0.00	8.03	43.12	23.94	13.56	8.83	2.23	0.22	0.04	0.02	111.3	5,389 +	18	0.165
19756	Gillnet	Jan-Apr	0.00	0.00	1.03	41.48	32.92	15.35	6.05	2.80	0.30	0.07	149.7	1,355 +	79	0.525
19778	Seine	Jan-Apr	0.00	0.81	41.60	18.95	15.70	17.59	3.84	1.17	0.23	0.11	111.8	7,925 +	75	0.670
	Gillnet	Jan-Apr	0.00	0.00	1.42	5.45	21.33	49.05	17.54	4.74	0.24	0.24	157.6	422 +	75	0.477
19789	Seine	Jan-Apr	0.00	0.82	13.88	50.49	14.19	10.61	7.80	1.59	0.50	0.11	124.1	3,769 +	422	3.401
	Gillnet	Jan-Apr	0.00	0.00	0.93	27.43	27.61	23.32	17.35	2.80	0.37	0.19	159.6	536 +	270	1.695
19790	Seine	Jan-Apr	0.00	7.17	82.08	8.96	1.43	0.00	0.00	0.36	0.00	0.00	84.3	279	0	0.000 ~
	Gillnet	Jan-Apr	0.00	6.28	46.56	15.12	18.71	5.93	4.93	2.07	0.32	0.07	106.6	4,014 +	519	4.873
19801	Seine	Jan-Apr	0.00	2.08	13.73	60.33	8.74	13.59	1.53	0.00	0.00	0.00	113.6	721	0	0.000 ~
	Gillnet	Jan-Apr	0.00	4.30	34.23	32.33	9.78	12.20	4.73	1.79	0.50	0.14	114.0	5,747 +	671	5.884
19812	Seine	Jan-Apr	0.00	0.60	30.57	8.73	47.59	4.07	7.53	0.75	0.15	0.00	118.6	664	238	2.011
	Gillnet	Jan-Apr	0.00	0.00	0.63	11.62	44.58	11.77	27.63	3.30	0.31	0.16	137.7	637 +	332	2.411
19823	Seine	Jan-Apr	0.00	3.96	20.79	31.68	10.89	28.71	0.00	3.96	0.00	0.00	108.4	101	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	0.31	13.52	22.73	47.00	5.99	9.98	0.31	0.15	138.0	651 +	163	1.181
19834	Gillnet	Jan-Apr	0.00	0.00	0.00	4.17	42.13	16.67	33.33	2.55	1.16	0.00	154.2	432	171	1.107
19856	Seine	Jan-Apr	0.00	2.21	23.62	63.47	2.58	1.48	1.85	2.58	2.21	0.00	136.5	271	0	0.000 ~
19867	Seine	Jan-Apr	0.00	17.02	27.66	15.96	35.46	1.06	0.00	1.06	0.35	1.42	131.2	282	0	0.000 ~
19878	Seine	Jan-Apr	0.00	2.16	62.53	11.05	6.20	15.36	1.62	0.81	0.00	0.27	121.3	371	0	0.000 ~
19889	Seine	Jan-Apr	0.00	0.21	12.66	57.51	8.15	8.37	11.37	1.29	0.43	0.00	151.3	466	0	0.000 ~
19890	Seine	Jan-Apr	0.00	1.84	22.68	14.25	39.63	5.83	7.13	7.78	0.65	0.22	158.0	926	0	0.000 ~
19901	Seine	Oct-Dec	0.01	6.71	22.27	20.52	10.65	32.59	2.99	3.50	0.73	0.03	131.8	7,680 +	0	0.001
	Seine	Jan-Apr	0.27	8.94	39.30	8.94	10.30	22.49	2.71	4.88	2.17	0.00	128.4	369	0	0.000 ~
19912	Seine	Jan-Apr	0.00	1.30	66.59	13.39	4.27	3.20	7.11	1.42	1.90	0.83	130.0	844	335	2.580
19923	Seine	Jan-Apr	0.00	11.30	35.79	38.93	5.02	1.57	1.41	5.02	0.31	0.63	108.5	637	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	3.28	53.28	14.09	7.92	7.53	11.58	0.97	1.35	146.6	518	367	2.502
19934	Seine	Jan-Apr	0.00	1.48	31.75	24.55	30.90	5.50	2.12	2.86	0.53	0.32	119.5	945	0	0.000 ~
	Gillnet	Jan-Apr	0.00	0.00	1.28	19.40	61.19	9.81	3.41	3.84	0.43	0.64	140.4	469	345	2.455
19945	Seine	Jan-Apr	0.00	1.29	6.83	30.93	27.19	25.26	5.28	1.55	1.29	0.39	130.6	776	88	0.670
	Trawl	May-Sep	0.00	1.68	6.37	35.29	24.37	24.65	4.13	1.33	1.61	0.56	131.3	1,428 +	0	0.000
19956	Seine	Jan-Apr	0.00	10.19	24.60	7.91	20.91	17.75	14.76	3.16	0.35	0.35	120.9	569	0	0.000 ~
	Trawl	May-Sep	0.00	10.19	24.60	7.91	20.91	17.75	14.76	3.16	0.35	0.35	120.9	569 +	0	0.000
19967	Seine	Jan-Apr	0.00	4.01	76.83	7.32	1.57	4.01	4.70	1.57	0.00	0.00	89.9	574	0	0.000 ~
19978	Seine	Jan-Apr	0.00	1.39	38.89	48.61	4.86	0.35	2.78	2.43	0.69	0.00	90.8	288	0	0.000 ~
19989	Seine	Jan-Apr	0.00	7.76	28.03	33.82	24.87	4.08	0.53	0.53	0.26	0.13	86.9	760	0	0.000 ~
19990	Seine	Jan-Apr	0.00	2.30	54.36	24.20	9.65	7.50	1.23	0.15	0.46	0.15	89.9	653	0	0.000 ~
20001	Seine	Jan-Apr	0.00	6.63	20.92	35.71	12.76	12.24	9.69	1.02	0.51	0.51	91.7	196	0	0.000 ~
20012	Seine	Jan-Apr	0.00	7.49	62.74	15.63	10.06	0.64	2.36	0.86	0.21	0.00	96.7	467	0	0.000 ~
20023	Seine	Jan-Apr	0.00	0.52	51.13	37.09	6.24	3.99	0.17	0.69	0.17	0.00	104.9	577	0	0.000 ~
20034	Seine	Jan-Apr	0.00	1.30	21.50	54.15	19.69	1.04	1.55	0.78	0.00	0.00	98.1	386	0	0.000 ~
20045	Seine	Jan-Apr	0.00	0.56	54.19	24.02	12.85	7.26	0.56	0.56	0.00	0.00	81.1	179	0	0.000 ~
20056	Seine	Jan-Apr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0	0	0.000 ~

Appendix 1.7. Age composition and catch by season, fishery and gear type for the Area 2W stock assessment region. These data are used for the age-structured model analysis.

			PERCENT AT AGE									Mean	Number	CATCH	
Season	Gear	Fishery	0+	1+	2+	3+	4+	5+	6+	7+	8+	9++	Weight	Aged	(tonnes)	(millions)
19567	Seine	Jan-Apr	0.07	20.00	25.34	16.22	9.41	25.92	2.46	0.47	0.11	0.00	104.2	4,506 +	106	1.016
19634	Seine	Jan-Apr	0.00	1.02	15.92	60.00	16.53	5.31	1.22	0.00	0.00	0.00	113.9	490 +	312	2.743
19645	Seine	Jan-Apr	0.00	1.59	80.07	10.20	5.14	1.78	0.84	0.37	0.00	0.00	104.0	1,069 +	1,251	12.030
19656	Seine	Jan-Apr	1.67	18.05	32.22	16.11	10.23	7.33	5.79	4.84	2.04	1.72	128.8	0 *	172	1.338
19723	Seine	Jan-Apr	0.00	0.16	38.08	21.42	26.62	10.93	1.93	0.80	0.05	0.00	144.7	1,867 +	706	4.878
19734	Seine	Jan-Apr	0.00	0.61	31.47	38.54	17.89	8.36	2.58	0.49	0.06	0.00	126.9	1,627 +	403	3.178
	Gillnet	Jan-Apr	0.00	50.98	11.11	5.88	15.69	5.88	9.15	1.31	0.00	0.00	101.0	153	0	0.000 -
19745	Seine	Jan-Apr	0.00	0.63	26.50	34.13	27.01	9.18	2.05	0.41	0.09	0.00	130.8	6,384 +	449	3.436
19756	Seine	Jan-Apr	0.00	23.71	6.70	41.24	23.71	4.64	0.00	0.00	0.00	0.00	139.8	194	0	0.000 -
19778	Seine	Jan-Apr	0.00	0.15	23.63	18.15	9.48	28.96	13.11	5.04	1.26	0.22	150.5	1,350 +	575	3.819
19789	Seine	Jan-Apr	0.00	1.49	18.84	22.95	16.23	22.95	13.81	1.87	1.12	0.75	151.9	536	691	4.546
19790	Seine	Jan-Apr	0.00	0.37	76.03	13.11	4.49	3.37	1.87	0.00	0.75	0.00	108.8	267	0	0.000 -
19801	Seine	Jan-Apr	0.00	4.98	1.87	66.92	11.97	6.35	5.02	1.79	0.84	0.26	132.9	1,232	770	5.808
19812	Seine	Jan-Apr	0.00	0.02	53.90	2.31	34.93	3.91	2.55	2.02	0.23	0.13	139.5	1,654	1,225	9.099
19823	Seine	Jan-Apr	0.00	0.50	1.52	68.64	3.59	20.49	2.37	1.43	0.83	0.64	151.9	3,356	2,518	16.808
19834	Seine	Jan-Apr	0.00	6.45	1.61	0.60	35.28	2.42	51.01	1.81	0.60	0.20	166.2	496	0	0.000 -
19845	Seine	Jan-Apr	0.00	0.40	0.67	5.80	2.56	13.75	1.62	74.39	0.67	0.13	212.3	742	199	0.940
19856	Seine	Jan-Apr	0.00	0.82	0.27	11.48	11.75	5.46	20.77	7.38	41.53	0.55	205.2	366	0	0.000 -
19867	Seine	Jan-Apr	0.00	22.14	61.32	0.25	1.27	1.27	1.27	8.14	1.02	3.31	112.0	393	0	0.000 -
19878	Seine	Jan-Apr	0.00	1.79	74.01	19.31	0.26	0.53	0.66	0.79	1.65	0.99	114.1	1,512	0	0.000 -
19889	Seine	Jan-Apr	0.00	0.49	3.42	76.06	15.88	0.49	0.49	0.98	0.81	1.38	137.6	1,228	0	0.000 -
19890	Seine	Jan-Apr	0.00	0.19	1.71	2.28	80.41	13.18	0.46	0.18	0.70	0.90	168.1	2,353	2,272	13.608
19901	Seine	Jan-Apr	0.00	0.50	6.46	0.89	1.84	68.91	19.83	0.72	0.45	0.39	173.3	1,795	2,558	14.762
19912	Seine	Jan-Apr	0.00	1.48	6.34	13.44	1.37	2.79	60.55	12.46	0.55	1.04	183.5	1,830	1,284	6.994
19923	Seine	Jan-Apr	0.00	0.76	11.71	16.46	13.53	1.91	4.57	44.54	5.67	0.84	156.7	2,574	1,306	7.985
19934	Seine	Jan-Apr	0.00	5.32	12.23	43.62	14.89	9.57	2.13	5.85	5.32	1.06	145.6	188	0	0.000 -
19978	Seine	Jan-Apr	0.00	18.50	34.75	23.10	18.68	2.62	0.63	1.53	0.18	0.00	120.8	1,108	180	1.487
19989	Seine	Jan-Apr	0.00	15.60	32.38	28.09	14.30	7.28	1.56	0.52	0.26	0.00	116.8	769	0	0.000 -
19990	Seine	Jan-Apr	0.00	14.77	63.64	18.18	0.00	2.27	0.00	1.14	0.00	0.00	85.0	88	0	0.000 -
20001	Seine	Jan-Apr	0.00	4.37	8.48	40.62	24.42	12.08	6.94	2.06	0.51	0.51	153.2	389	0	0.000 -
20012	Seine	Jan-Apr	0.00	28.69	23.83	4.77	21.64	9.72	6.86	2.67	1.53	0.29	130.5	1,049	0	0.000 -
20023	Seine	Jan-Apr	0.00	1.03	73.49	15.31	3.39	3.69	1.15	1.33	0.36	0.24	111.3	1,652	0	0.000 -
20034	Seine	Jan-Apr	0.00	7.24	9.74	71.71	7.50	1.71	1.58	0.26	0.00	0.26	124.5	760	0	0.000 -
20045	Seine	Jan-Apr	0.00	0.36	26.68	8.63	58.76	4.04	0.54	0.81	0.00	0.18	122.7	1,113	0	0.000 -
20056	Seine	Jan-Apr	0.00	10.75	13.98	17.63	6.88	44.95	3.44	1.72	0.65	0.00	132.4	465	0	0.000 -

NOTE: * No biosample data available. Age composition and mean weight assigned from published reports.
+ Age composition calculated from biosample data aggregated from adjacent sections and/or fishery periods, by gear type.
- No fishery openings this season. Age composition and mean weight obtained from pre-fishery charter

Appendix table 2.1. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Queen Charlotte Is. stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	3461	2100	1734	320	163	47	7	1	0	3491	4213	1.25
1951/52	10446	1771	1028	784	131	60	15	2	0	6505	2578	-1.53
1952/53	29205	5531	731	341	228	35	15	4	1	10250	7555	0.02
1953/54	4821	17528	3319	439	205	137	21	9	3	11206	12408	1.04
1954/55	4147	2955	10636	1977	255	115	75	12	6	10900	6437	-0.53
1955/56	2015	2436	1732	6200	1141	144	63	40	10	9722	6042	-0.41
1956/57	2851	1064	669	280	720	107	12	5	4	1650	1592	0.69
1957/58	6917	1200	108	44	15	36	5	1	0	7220	815	-4.67
1958/59	2443	2692	319	28	11	4	9	1	0	5194	8981	2.15
1959/60	8595	1374	1098	108	9	3	1	3	0	8787	6599	0.07
1960/61	9968	4668	746	596	59	5	2	1	2	9035	8981	0.77
1961/62	17153	5155	2389	377	298	29	2	1	1	9819	5730	-0.56
1962/63	4710	8494	2399	1011	144	104	9	1	1	11837	7297	-0.43
1963/64	11905	2240	3641	887	324	41	27	2	0	4695	4104	0.45
1964/65	2300	5148	690	746	129	36	4	2	0	2660	1378	-0.86
1965/66	4146	714	506	42	37	6	1	0	0	2467	2824	1.12
1966/67	3762	1204	164	104	8	7	1	0	0	1095	710	-0.30
1967/68	4919	863	272	36	23	2	1	0	0	2108	833	-1.54
1968/69	4485	1298	226	71	9	6	0	0	0	2846	2075	-0.01
1969/70	6596	1703	493	86	27	4	2	0	0	7545	5552	0.02
1970/71	6636	3077	795	230	40	13	2	1	0	14717	13291	0.53
1971/72	13534	3464	1602	413	120	21	7	1	1	8426	9542	1.09
1972/73	10999	7461	1830	789	188	50	8	3	1	7486	7960	0.94
1973/74	9396	6207	4019	901	341	68	15	2	1	25389	14510	-0.62
1974/75	4752	5499	3498	2147	457	166	32	7	2	29291	9686	-1.98
1975/76	5833	2922	3268	1975	1148	233	81	16	4	17922	16374	0.56
1976/77	9959	3699	1792	1870	1003	491	80	28	7	20244	16408	0.26
1977/78	5390	6039	2160	971	912	427	181	30	13	9368	18371	2.47
1978/79	114732	2975	3247	1088	429	322	98	41	9	10757	13649	1.38
1979/80	8820	55418	1399	1432	420	139	82	25	13	40180	31904	0.21
1980/81	2680	3645	22742	566	542	148	47	27	12	48438	20294	-1.39
1981/82	1741	1078	1448	8807	209	184	47	15	13	42796	23593	-0.71
1982/83	13073	803	491	646	3838	88	74	19	11	46981	21391	-1.18
1983/84	7446	6872	397	239	310	1825	42	35	14	25917	23439	0.53
1984/85	2398	4283	3845	214	123	155	890	20	24	18180	18625	0.84
1985/86	3408	1353	2369	2034	105	56	64	362	18	12355	6847	-0.69
1986/87	22585	1823	717	1225	1007	49	23	27	157	11075	12289	1.04
1987/88	10127	12102	969	375	623	491	22	11	84	22459	15245	-1.11
1988/89	5091	5361	6405	513	198	330	260	12	50	39964	25201	-1.32
1989/90	3627	2777	2900	3432	273	105	174	137	32	20674	27058	0.77
1990/91	33506	1997	1497	1501	1659	121	42	69	67	14112	17998	0.70
1991/92	3984	17310	1016	738	702	718	47	16	52	13481	12376	-0.24
1992/93	4883	1814	7825	452	320	292	279	18	27	10754	8152	-0.79
1993/94	13970	2026	745	3142	175	117	99	94	15	7486	14293	1.85
1994/95	20875	5589	810	297	1245	69	45	38	42	5207	4701	-0.29
1995/96	19248	7407	1983	287	105	442	24	16	28	7303	7377	0.03
1996/97	35687	7123	2741	734	106	39	163	9	16	11310	11215	-0.02
1997/98	2045	14233	2841	1093	293	42	16	65	10	19651	21649	0.28
1998/99	6554	773	5306	1041	395	105	15	6	27	11032	10610	-0.11
1999/00	6798	2282	261	1704	316	109	26	4	7	6945	6698	-0.10
2000/01	4896	2247	724	78	489	87	29	7	3	12789	15195	0.49
2001/02	22966	1538	706	227	25	154	27	9	3	3374	3257	-0.10
2002/03	7452	7262	471	207	64	7	41	7	3	8753	8801	0.02
2003/04	6075	2443	2387	154	68	21	2	13	3	5687	5668	-0.01
2004/05	7401	2043	821	803	52	23	7	1	6	3656	3614	-0.03
2005/06	6779	2544	702	282	276	18	8	2	2	5838	5926	0.04

Estimated average availability at age (Si):

0.04 0.27 0.48 0.66 0.83 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.01 0.05 0.23 0.54 0.75 0.87 0.95 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.73

Appendix table 2.2. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Prince Rupert District stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	8981	9418	10689	1540	562	246	24	6	0	29668	27149	0.91
1951/52	10980	4913	4320	3894	453	151	64	6	2	14656	24047	2.37
1952/53	18586	5919	2150	1353	808	75	23	10	1	30298	28468	0.98
1953/54	4455	9836	3094	1109	690	411	38	12	6	11055	13535	1.64
1954/55	10614	2355	4618	1160	295	145	80	7	3	16534	14482	0.80
1955/56	3363	5842	1151	1903	401	94	45	25	3	41373	14533	-1.48
1956/57	5518	1853	2896	564	929	196	46	22	14	18270	27518	2.16
1957/58	9161	3194	671	892	163	264	55	13	10	37655	9882	-2.21
1958/59	2683	5663	1879	393	522	96	155	32	14	35783	40961	1.47
1959/60	14685	1816	3424	1077	220	291	53	86	26	54032	16545	-1.83
1960/61	7578	9475	1030	1925	604	123	163	30	62	47481	12059	-2.29
1961/62	4282	5359	4623	458	829	258	53	69	39	52002	26329	-0.57
1962/63	11697	3243	3322	2595	246	440	136	28	57	64607	16981	-2.21
1963/64	2365	7209	1643	1664	1296	123	219	68	43	55007	26919	-0.65
1964/65	1375	1598	3803	840	842	654	62	111	56	30743	6055	-2.93
1965/66	2805	764	541	1207	261	261	202	19	51	4432	7105	2.31
1966/67	3954	1575	359	185	264	42	38	30	10	9860	3386	-1.54
1967/68	2818	1390	457	103	53	75	12	11	11	8870	5197	-0.20
1968/69	7444	1127	514	168	38	19	28	4	8	1631	965	-0.18
1969/70	5359	3415	517	236	77	17	9	13	6	17523	8814	-0.58
1970/71	2377	2734	1684	253	115	38	8	4	9	17394	8480	-0.66
1971/72	8161	1339	1423	849	126	57	19	4	7	5983	8774	2.09
1972/73	8842	4946	790	788	401	49	20	7	4	13388	10959	0.63
1973/74	6129	5381	2977	465	447	221	27	11	6	21820	9244	-1.01
1974/75	3480	3743	3242	1725	245	225	110	13	8	20800	10775	-0.51
1975/76	5769	2127	2274	1944	1008	140	128	62	12	12481	15587	1.69
1976/77	3197	3432	1261	1332	1091	509	63	57	34	16520	11323	0.19
1977/78	2903	1735	1833	645	601	428	187	23	33	14591	5724	-1.21
1978/79	21229	1496	865	835	245	202	138	60	18	9181	9195	1.14
1979/80	6259	11411	791	433	369	96	75	51	29	22546	11937	-0.46
1980/81	5360	3376	6024	398	199	163	42	33	35	20553	14087	0.19
1981/82	5658	3045	1891	3283	205	98	79	20	32	27796	17186	-0.07
1982/83	10893	3366	1796	1100	1876	116	55	44	30	38927	24735	0.00
1983/84	2671	6788	2097	1119	685	1169	72	34	46	39198	26699	0.17
1984/85	2328	1689	4236	1288	662	388	636	37	41	52651	40650	0.49
1985/86	7181	1468	1028	2526	742	359	196	298	35	42106	26353	-0.04
1986/87	5209	4695	922	607	1385	394	187	101	170	35709	39628	1.39
1987/88	3523	3443	3042	575	347	742	204	96	137	29788	35042	0.46
1988/89	1941	2265	2145	1813	311	161	310	85	93	28358	15959	-1.64
1989/90	7090	1207	1347	1212	912	125	58	101	58	23570	22288	-0.16
1990/91	6064	4482	743	794	665	463	60	28	75	26370	25519	-0.09
1991/92	2794	3873	2814	450	451	360	236	30	49	37769	39833	0.15
1992/93	1520	1777	2412	1714	238	208	155	95	29	23143	24638	0.18
1993/94	3798	967	1104	1426	915	98	69	47	32	13511	16180	0.52
1994/95	12155	2402	602	661	775	431	34	22	22	13467	18231	0.87
1995/96	5922	7554	1485	367	383	421	218	16	20	18137	24444	0.85
1996/97	7607	3531	4503	874	200	168	170	79	12	33028	25037	-0.79
1997/98	2362	4417	2048	2581	454	81	47	37	14	22827	19420	-0.46
1998/99	5424	1358	2539	1172	1436	238	31	13	8	25600	29292	0.39
1999/00	8821	3130	781	1438	643	733	118	13	8	20859	19320	-0.22
2000/01	5685	5067	1767	430	722	300	297	36	6	21941	36362	1.44
2001/02	20026	3237	2850	973	227	335	136	124	17	18939	21987	0.43
2002/03	3244	11200	1770	1505	470	94	114	42	34	30181	33631	0.31
2003/04	10337	1739	5919	917	708	181	29	33	20	24910	30085	0.54
2004/05	4032	5425	897	2959	429	281	50	6	9	19113	26105	0.89
2005/06	4085	1923	2538	409	1238	167	86	8	2	14116	10251	-0.91

Estimated average availability at age (Si): 0.09 0.42 0.65 0.85 0.96 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.01 0.15 0.37 0.57 0.73 0.88 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.63

Appendix table 2.3. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Central Coast stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	11358	9976	8841	1425	548	130	7	0	0	29186	15390	0.57
1951/52	15542	5241	3876	2820	380	136	31	2	0	15113	10295	1.21
1952/53	55072	7180	2033	1183	659	78	26	6	0	20487	18237	1.88
1953/54	4998	25921	3365	947	547	304	36	12	3	40478	13967	-0.49
1954/55	4338	2205	9994	1178	313	177	97	11	5	52538	13564	-1.21
1955/56	8425	1979	922	4105	481	127	72	40	7	15553	6626	0.04
1956/57	11547	3873	483	182	740	84	22	13	8	6248	4607	1.41
1957/58	13582	5925	1129	98	30	113	13	3	3	21643	3549	-2.35
1958/59	3571	7539	2764	499	42	13	49	5	3	9494	3904	-0.05
1959/60	6470	2133	3258	817	113	9	2	9	2	39842	12615	-0.70
1960/61	15176	3839	1235	1884	489	65	5	1	6	13153	4265	-0.65
1961/62	9897	9146	1484	354	450	110	14	1	2	20812	11948	0.78
1962/63	8192	5958	4769	674	145	177	43	6	1	8643	6485	1.45
1963/64	5230	4437	2170	1121	105	19	21	5	1	15700	6464	-0.05
1964/65	5687	2263	1111	480	236	22	4	4	1	5502	2097	-0.24
1965/66	11432	2589	734	263	89	40	4	1	1	5726	1863	-0.64
1966/67	5637	3428	283	69	24	8	4	0	0	8790	5434	0.97
1967/68	3203	1823	643	50	12	4	1	1	0	11749	5790	0.40
1968/69	8960	1266	690	242	19	5	2	1	0	4653	1837	-0.15
1969/70	6132	3685	521	284	100	8	2	1	0	32080	8230	-1.23
1970/71	5514	2863	1718	243	132	46	4	1	0	23652	4156	-2.18
1971/72	8437	3080	1504	883	124	67	24	2	1	9106	3572	-0.17
1972/73	6813	5361	1785	749	354	43	22	8	1	22791	12434	0.66
1973/74	9333	4477	3323	1009	381	171	21	10	4	15594	8852	0.76
1974/75	5582	6073	2860	1964	477	135	50	6	4	37753	8037	-1.70
1975/76	5270	3495	3719	1636	972	213	57	21	4	30839	13849	0.17
1976/77	9039	3230	2062	2038	735	367	72	19	8	26342	14613	0.70
1977/78	6342	5266	1831	1084	899	268	123	24	9	12541	7747	0.97
1978/79	44839	3458	2789	875	379	177	31	12	3	14474	5779	-0.12
1979/80	8855	24177	1865	1504	472	204	95	17	8	12402	13012	2.29
1980/81	7152	4752	12972	1000	798	243	100	47	12	78398	15919	-1.82
1981/82	2804	3769	2498	6734	502	376	108	43	25	66153	16333	-1.33
1982/83	2410	1604	2130	1378	3530	255	185	52	32	45343	18482	-0.07
1983/84	7203	1456	960	1248	770	1890	133	96	43	32232	14185	0.12
1984/85	3903	4399	868	549	669	388	918	62	62	33125	8850	-1.13
1985/86	6497	2331	2559	482	289	343	194	457	62	29466	20342	1.25
1986/87	31727	3822	1345	1428	259	152	178	101	268	23559	12827	0.65
1987/88	3043	18087	2146	732	736	129	74	87	180	39921	26916	-1.13
1988/89	2286	1664	9709	1118	364	352	61	35	126	40602	21561	-1.81
1989/90	5776	1279	900	4990	512	152	135	23	61	30223	28980	-0.12
1990/91	23668	3432	744	502	2542	234	64	56	35	24345	19183	-0.68
1991/92	3801	14542	2043	418	254	1186	103	28	39	38062	43274	0.37
1992/93	5074	2336	8595	1145	219	128	576	49	32	41736	32392	-0.72
1993/94	2130	3043	1340	4636	570	102	57	248	34	41818	29422	-1.00
1994/95	6513	1246	1643	675	2187	258	44	24	119	22228	22348	0.02
1995/96	22314	3817	688	832	306	922	104	18	56	18206	21646	0.49
1996/97	23885	13041	2167	373	421	148	435	49	35	24269	28255	0.44
1997/98	5227	13829	7393	1190	196	213	73	214	41	28012	31503	0.34
1998/99	9116	2916	7446	3756	556	85	84	28	96	32474	31813	-0.06
1999/00	4367	4958	1548	3788	1771	246	33	29	41	33975	32652	-0.11
2000/01	11146	2323	2550	761	1749	781	105	14	29	22975	25109	0.25
2001/02	26193	5909	1191	1240	345	754	326	43	17	21545	23147	0.21
2002/03	6664	13858	3049	594	593	161	343	146	27	22118	25679	0.43
2003/04	21149	3366	6910	1488	279	270	72	152	76	23284	29407	0.67
2004/05	4422	10021	1565	3122	649	120	115	30	97	23157	24158	0.12
2005/06	4139	1823	3996	599	1150	235	43	41	46	14905	12051	-0.61

Estimated average availability at age (Si): 0.08 0.38 0.62 0.84 0.94 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.02 0.15 0.40 0.65 0.82 0.92 1.00 1.00

Spawn index-escapement conversion factor (q) is 0.42

Appendix table 2.4. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the Strait of Georgia stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	20550	10272	3856	843	167	40	11	3	0	31385	66143	1.73
1951/52	23854	10978	3884	1160	235	46	11	3	1	44000	72376	1.11
1952/53	33455	12743	4187	1283	369	74	14	3	1	65781	111307	1.18
1953/54	23862	19337	6999	2241	682	196	39	8	2	45416	82141	1.34
1954/55	15080	13830	9104	2460	668	192	55	11	3	79898	69854	-0.47
1955/56	16410	8051	5426	3209	844	228	65	19	5	30653	25667	-0.58
1956/57	14074	8378	2561	1245	658	168	45	13	5	14853	24126	1.08
1957/58	26057	6828	2070	415	175	89	23	6	2	15733	16149	-0.07
1958/59	17759	13915	2858	671	120	49	25	6	2	54051	47864	-0.44
1959/60	9881	9686	5271	1007	222	38	16	8	3	44643	55082	0.39
1960/61	24955	5273	3039	1495	280	61	11	4	3	32499	42864	0.55
1961/62	22080	13677	1750	901	433	80	18	3	2	28142	31078	0.11
1962/63	25862	12435	4396	421	199	93	17	4	1	28681	35135	0.37
1963/64	17781	14126	3820	1013	89	41	19	4	1	23018	33117	0.77
1964/65	11201	8675	3994	714	163	14	6	3	1	32329	37116	0.21
1965/66	18697	3772	1893	820	145	33	3	1	1	8021	7153	-0.42
1966/67	12811	5617	586	212	83	14	3	0	0	9670	9619	-0.15
1967/68	9371	2835	659	64	23	9	2	0	0	10416	9128	-0.47
1968/69	14427	2592	738	169	16	6	2	0	0	20951	14644	-1.03
1969/70	12158	5297	948	270	62	6	2	1	0	33069	33970	-0.07
1970/71	10333	5476	2378	425	121	28	3	1	0	35657	38180	0.03
1971/72	12004	4718	2455	1056	188	53	12	1	1	28140	25165	-0.42
1972/73	17170	5199	1793	865	361	64	18	4	1	19128	16191	-0.56
1973/74	19379	7796	2233	676	282	112	20	6	1	53167	40354	-0.83
1974/75	12628	9753	3878	1000	288	118	47	8	3	59705	70211	0.27
1975/76	26002	6824	5217	1938	393	100	40	16	4	47723	60642	0.46
1976/77	23494	14691	3771	2596	829	153	38	15	7	79569	78562	-0.17
1977/78	13671	13609	8120	1896	1134	329	59	15	9	72034	102115	0.73
1978/79	22610	7690	7241	3908	771	402	111	20	8	61285	64266	-0.02
1979/80	18707	12406	4097	3538	1671	304	156	43	11	91784	85991	-0.30
1980/81	18871	9909	6498	2108	1740	798	144	74	25	95809	55121	-1.52
1981/82	16686	9586	4860	3088	930	732	331	59	41	79925	100987	0.45
1982/83	14989	7997	4394	2108	1264	352	273	122	37	45203	64575	0.75
1983/84	17477	6169	3053	1452	577	316	80	59	34	35084	26227	-0.87
1984/85	21052	6525	2155	947	346	117	63	15	17	41932	25247	-1.41
1985/86	9694	8870	2611	787	291	91	29	16	8	62003	41575	-1.14
1986/87	24342	4655	4239	1247	376	139	44	14	11	49875	41737	-0.58
1987/88	7796	13144	2399	2016	485	112	32	9	5	66349	24976	-2.79
1988/89	18781	4105	6758	1131	821	178	37	10	4	72121	66052	-0.25
1989/90	10791	10476	2236	3493	503	327	65	13	5	80477	67152	-0.52
1990/91	28502	5845	5635	1151	1534	189	116	23	6	65135	45830	-1.00
1991/92	19818	15363	3089	2767	477	538	60	35	9	83090	82656	-0.02
1992/93	22699	10646	7988	1487	1125	167	179	19	14	118072	90198	-0.77
1993/94	10897	11995	5425	3817	629	428	59	63	12	82050	67144	-0.57
1994/95	20030	5420	5705	2366	1364	167	100	11	12	67275	64899	-0.10
1995/96	27777	9503	2457	2407	849	438	49	29	7	66756	71326	0.19
1996/97	28106	13598	4337	1056	893	265	128	14	10	69299	58232	-0.50
1997/98	13240	14204	6352	1886	386	246	62	27	4	68637	74616	0.24
1998/99	20420	6855	7007	2960	779	131	56	9	3	68442	85095	0.62
1999/00	23174	10602	3382	3242	1197	252	35	12	2	75127	72639	-0.10
2000/01	33058	12028	5190	1581	1333	344	55	5	2	73194	100248	0.90
2001/02	38644	17869	6125	2491	634	430	88	13	2	92847	117864	0.68
2002/03	24957	21835	9523	3056	1123	199	108	16	1	95204	141651	1.14
2003/04	22282	13965	11656	4753	1386	466	56	20	5	117447	113689	-0.09
2004/05	13220	11504	6913	5587	2170	576	184	17	8	94459	100760	0.18
2005/06	22194	5949	4889	2842	2079	679	147	41	6	54490	46752	-0.44

Estimated average availability at age (Si): 0.09 0.70 0.92 0.98 1.00 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.02 0.19 0.47 0.70 0.83 0.93 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 1.06

Appendix table 2.5. Estimates of numbers at age, spawning stock biomass (SB), spawn index (SI), estimated spawn-observed spawn residuals (RES), and other parameters from age-structured analysis for the west coast of Vancouver Island stock assessment region.

	Estimated numbers at age (x10-5) for period 1											
Season	1+	2+	3+	4+	5+	6+	7+	8+	9+	SB	SI	RES
1950/51	26198	8337	8195	1106	254	54	4	4	0	53974	19597	-1.28
1951/52	32960	10492	2898	2746	365	83	18	1	1	10560	13310	1.83
1952/53	42337	12881	3583	831	650	72	13	3	0	42395	39571	1.08
1953/54	30693	14216	4324	1203	279	218	24	4	1	21451	20648	1.15
1954/55	39579	9194	3290	862	221	49	37	4	1	32818	15112	-0.69
1955/56	41036	12877	2820	991	258	66	15	11	1	38084	27183	0.41
1956/57	30919	16182	4444	924	317	82	21	5	4	54077	44114	0.74
1957/58	31953	13067	6730	1836	381	131	34	8	3	68722	18986	-1.97
1958/59	25456	13348	5440	2800	764	158	54	14	5	16333	12979	0.68
1959/60	17826	10183	3355	987	406	95	17	6	2	9435	6015	0.12
1960/61	50981	6055	1821	423	102	38	8	1	1	18572	10556	-0.16
1961/62	28693	18844	1544	414	92	22	8	2	0	34823	34470	1.22
1962/63	47415	11366	6314	476	122	26	6	2	1	14804	11245	0.56
1963/64	27208	18461	3998	1971	132	31	6	1	1	29351	22761	0.61
1964/65	26396	9341	5692	1128	523	34	8	1	0	17653	11891	0.26
1965/66	24063	7446	2408	1339	246	108	7	1	0	6818	3722	-0.26
1966/67	25393	5706	1623	471	234	39	15	1	0	8950	4813	-0.30
1967/68	21557	5889	1039	256	68	32	5	2	0	17537	11029	0.09
1968/69	35032	5494	1501	265	65	17	8	1	1	16984	10465	0.04
1969/70	44423	11255	1765	482	85	21	6	3	1	43274	26912	0.06
1970/71	25426	17940	4545	713	195	34	8	2	1	59528	36206	0.01
1971/72	28431	11338	8000	2027	318	87	15	4	2	33335	41857	1.82
1972/73	31361	13377	5201	3549	867	131	34	6	2	29536	19481	0.21
1973/74	47509	15186	6138	2196	1347	297	39	10	2	102719	25540	-2.23
1974/75	22928	26061	7851	3017	1017	604	131	17	6	94361	49149	-0.38
1975/76	23534	13706	14923	4172	1429	452	254	55	10	66224	64222	1.17
1976/77	53173	13995	7823	7817	1785	505	130	72	18	57055	58679	1.32
1977/78	19056	29835	7624	3968	3508	682	159	41	28	63414	45607	0.43
1978/79	50415	9815	15149	3734	1692	1230	187	42	18	85499	66397	0.62
1979/80	32678	26376	5011	7448	1663	688	467	70	23	132462	62308	-0.64
1980/81	18456	16531	13276	2505	3656	798	326	221	44	138447	52063	-1.20
1981/82	11662	8498	7476	5921	1083	1551	333	136	111	81422	33047	-1.01
1982/83	16668	4693	3375	2921	2250	395	555	117	86	45568	16771	-1.25
1983/84	32849	6277	1681	1158	953	711	122	171	62	44580	23872	-0.31
1984/85	27599	13434	2403	621	418	340	252	43	82	87601	30010	-1.43
1985/86	12112	12253	5957	1065	275	185	151	112	56	75023	39514	-0.35
1986/87	70896	5709	5769	2802	501	130	87	71	79	41111	16858	-0.98
1987/88	17558	37155	2823	2629	1174	198	48	32	55	34662	46242	0.82
1988/89	26417	9070	18863	1387	1222	513	77	19	34	53975	47718	-0.35
1989/90	20240	12235	4106	8173	562	463	180	27	18	46848	46464	-0.02
1990/91	63142	8556	5066	1642	3118	206	160	62	16	26778	30456	0.16
1991/92	38298	27863	3705	2115	646	1141	68	53	25	39797	42687	0.20
1992/93	31517	17025	12283	1610	899	269	460	27	31	34521	34728	0.02
1993/94	15822	13384	7129	5037	643	348	99	170	22	47089	25625	-1.74
1994/95	19839	6069	5024	2605	1787	222	117	33	64	19919	28057	0.98
1995/96	82155	8038	2444	2004	1025	690	83	44	36	30377	33986	0.32
1996/97	33710	36089	3516	1064	868	442	296	35	34	44857	46490	0.10
1997/98	21832	14452	15103	1431	421	336	167	112	26	32081	41556	0.74
1998/99	25590	8165	5289	5332	480	127	88	42	34	22114	20390	-0.23
1999/00	30883	8136	2542	1598	1527	131	31	21	17	14320	13267	-0.22
2000/01	38161	9965	2607	804	489	447	36	8	10	14176	13955	-0.05
2001/02	41490	14009	3658	957	295	180	164	13	7	21363	22086	0.10
2002/03	24447	16541	5566	1444	371	111	65	59	7	19294	29750	1.24
2003/04	33506	9027	6009	1971	484	112	29	16	17	13720	15844	0.41
2004/05	26403	10136	2639	1669	514	114	23	5	5	10457	9075	-0.41
2005/06	29072	6714	2436	593	328	87	13	2	1	2777	2705	-0.08

Estimated average availability at age (Si): 0.02 0.36 0.57 0.73 0.85 1.00 1.00 1.00 1.00

Estimated average relative selectivity at age for gillnet fisheries: 0.00 0.03 0.23 0.54 0.76 0.88 0.95 1.00 1.00

Spawn index-escapement conversion factor, pre-dive era (q) is 0.61